GLOW FLIERS—You Can't Handle this Electric Sailplane?

MODEL AIRPLANE NEWS

48120 MAY 1991

THE WORLD'S PREMIER R/C

Doomed Squadron

Full-Scale R/C

CONSTRUCTION
Electric Wizard

COMPUTER BUFFS
Aerochopper
Flight Simulator

SHURIKEN
47,000 RPM!
ENGINE REVOLUTION

DESERT STORM
FIGHTING AIRCRAFT

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MAY 1991 VOLUME 119, NUMBER 5

MODEL AIRPLANE NEWS

ON THE COVER: main photo—a QF-4N fighter flown from the ground by R/C; left center—a pilotless F-86 Sabre is flown by R/C (both photos are by Rob Wood; see "Doomed Squadron," page 52) Top right—the Aeronaut Sunfly (see review, page 93). Bottom left—the revolutionary Shuriken engine (page 82).

FEATURES

CONSTRUCTION

HELICOPTER SECTION

COLUMNS

COLUMNS

DEPARTMENTS

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EDITORIAL

by TOM ATWOOD

Left to right: Group Publisher Louis DeFrancesco, Associate Editor Gerry Yarrish and Editor-in-Chief Tom Atwood (carrying electric Klingberg Wing) return from a flying session .

THE CONTINUING evolution of R/C modeling technology at times staggers the imagination: see the "Doomed Squadron" (full-scale R/C) and the Shuriken engine review (47,000rpm without a tuned pipe) in this issue. Also in this issue, don't miss our survey of the principal fighting aircraft being used in the Middle East.

Although no one doubts that the ever-improving, nitro-breathing fire dragons we call glow engines (or their gas-guzzling, or diesel-drinking cousins) will continue to impress and thrill most R/C modelers, I'll wager that electric-powered flight will make serious gains in our hobby. Many seasoned modelers simply dismiss electric power as a "cute" or anemic imitator. To me, they're missing the point.

We want to promote growth in the hobby, and electric power can help. It's clean, reliable and doesn't intimidate beginners. An electric glider can be built from plans and powered by a "can" motor at very low cost. Electrics are quiet, making it easier to find and keep flying sites. The power-to-weight ratio isn't as high, but this becomes an interesting design challenge. Multi-motor designs are nearly immune to single-motor "flame-outs," and unlike an internal-combustion engine, an electric motor will increase power output under load, making a hot performer even hotter.

To help spread the word, in this issue, we feature an electric construction project and three electric sailplanes, from beginner to advanced level (the F3E-like Sunfly would be a challenging handful for most "Sunday" glow-power fliers). As for bringing new blood into the hobby, why not build and fly electrics, in competition, as part of a formal program at high schools? It involves science, engineering and more thrills than most video games.

A reminder to anyone who missed our last issue: we're running our second Great R/C Design Contest (see ad), and cash prizes total $3,600! If you have an original scale, sport, or experimental design in mind, now's the time to get to work! We (and our readers) want to see your creations. ■

MODEL AIRPLANE NEWS

THE WORLD'S PREMIER R/C MODELING MAGAZINE

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AIRWAVES

WHERE TO WRITE TO US
If you're writing to the editors (and we'd love to hear from you), please be sure to address your letters to "Airwaves," *Model Airplane News*, 251 Danbury Road, Wilton, CT 06897. Only subscription orders and inquiries are handled by our Customer Service Department in Mount Morris, IL; other mail addressed there must be forwarded to Connecticut, and this leads to long delays.

A REAWAKENING

I'm an old-timer with a large collection of *MAN*—from 1929 to 1951. When I saw the January '91 issue, I bought it immediately because of the historical cover and the splendid article on Joe Kovel and the KG. I was nearly overcome with nostalgia as I've been out of touch with the hobby for so many years.

A few questions: how does one join the Society of Antique Modelers, which is apparently the old-timers group? I didn't know that one existed. My first gas engine was a Brown Jr. Model B (the big one); I paid $21.50 for it (or, rather, my parents did). That was a lot of money in the Depression. Where can I buy an antique Model B? I expect that these engines are in great demand. I'm really tempted to buy the plans, build another KG and install a Model B in it (we called the finished product "gassies" and "gas jobs" then). My life as a modeler would thus have come full circle.

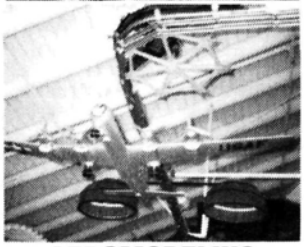
I'm amazed to see that Edward Packard is still active and advertising. My first, detailed, 3/4-inch Cleveland scale, on which I spent many months of spare time, was his Curtiss Goshawk FIIC-2.

What ever happened to Joe Kotula, who did those wonderful action covers for decades? Needless to say, I've sent in a subscription card for *MAN*. You must get a lot of letters like this one, from reawakening ancients!

RONALD WILKINSON
Washington, D.C.

Ron, thank you for your kind letter, and yes, we have received many letters of appreciation for that issue, which had a vintage cover and theme. The Society of Antique Modelers would welcome you to their ranks. You can write to their newsletter, "Sam Speaks," for more information: c/o Sec'y Bob Dodds, 209 Summerside Ln., Encinitas, CA 92024. We ran a cover story on Joe Kotula in our July '90 issue, and it generated an enthusiastic response. As for getting

an antique Brown Jr. engine, I'll pass on any information to you that we receive in response to your letter. TA



AEROMODELING AMBIENCE

While on vacation in '84, I discovered a good restaurant in Morgan Hill, CA (near San Jose) called the "Flying Lady." As you can see, any model airplane buff would be in seventh heaven dining there. All this *and* a good meal! The models go around above the diners very slowly on an overhead track.

My wife and I parked ourselves in a corner where the track made a 90-degree turn and started taking pictures. I used up a 36-picture roll and still didn't take as many as I would have liked to. In an adjoining hangar, they had many full-size planes on display, and I'm told they have a "flyable" Ford Tri-Motor, but when I was there, it was at an air show. For anyone visiting the area, I feel a trip to the Flying Lady would be time well spent. Best regards from a reader of *MAN* for 55 years.

A LIFELONG MODELER
Ozona, FL

Thanks for the pictures. For readers planning to visit the area, the Flying Lady is still in business and has more than 50 models hanging from its ceiling track. (We're sorry this writer didn't include his name.) TA

MORE ON NI-CDS

Your answers to Jack Boyt's inquiry on Ni-Cd care were good. In the interest of increasing modelers' understanding, I'd like to add the following:

The "built-in number of cycles" attributed to Ni-Cds' life depends greatly on how the cells are cycled. Deep discharge on each cycle will usually result in between 400 and 600 cycles. As the depth of discharge *decreases*, the number of "use" cycles increases dramatically. In the R/C plane transmitter/receiver application, one seldom approaches the fully discharged pack without incurring a significant risk of losing (crashing) the model. Under this type of a discharge regime, the cycles aren't the limiting factor. If they were, you could expect to get 1 1/2 hours of actual air time without

(Continued on page 10)

AIRWAVES

worrying about replacing your transmitter or receiver packs until well into the next century.

The bad news is that the *aging* of the battery, regardless of the number of cycles, is the most significant factor. Anyone who claims a 10-year life is stretching it. With more than 20 years of industrial testing of thousands of cells from every major manufacturer, the mean time to failure of a Ni-Cd cell is closer to 8 years (at 77°F). This is for a single cell; a multiple-cell battery reduces the mean time to failure to 5.7 years for 4-cell receiver packs and 4.8 years for 8-cell transmitter packs. *This is mean time to failure—the time at which 50 percent of a group of batteries will have failed.*

Using a pack this long for control purposes is unacceptable (and potentially very hard on models). A statistical failure probability of 0.1 percent, or, as a maximum, 1.0 percent, would seem more acceptable. With these figures as a target, we're looking at useful life in the 1- to 2-year range before the battery pack should be replaced. Disciplined battery monitoring will give the modeler adequate notice that his pack is approaching the end of its life, and will therefore allow him to extend the use. Higher than normal self-discharge is a key indicator that the pack should be replaced.

Reversal shouldn't be a concern with system packs. Anywhere from .9 volt to 1.1 volts per cell cut-off when testing is fine. At the high rates seen in electric-propulsion applications, the reversal is even less of a concern. As a cell reaches the end of discharge, its internal resistance goes up dramatically, such that the cell can become reversed *electrically* but not chemically. Try "force-discharging" a cell at 10 amps. You can drive it to a negative voltage, but when the 10A discharge current is removed, the cell will spring back to a positive voltage.

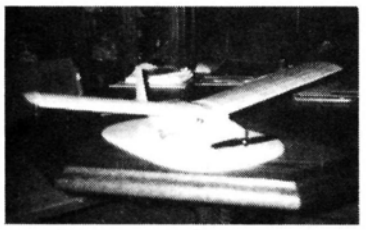
As far as single cells are concerned, it's impossible to reverse them with a passive (resistive) load. In fact, one of the standard tests in the industry is to short out discharged cells (single cells, *not* a battery) for 10 to 12 hours and see if they recover after the short is removed. A good cell will bounce back to more than 1 volt, but a cell with a high shorting potential won't.

Tests have also proven that maintaining cells in a fully charged state is better accomplished with pulse charges than with a continuous trickle-charge. Just plug your system charger into a clock timer after the initial overnight charge, and you can leave it for months. Set the timer to charge about one hour a day, and forget it until you're ready to fly. This technique works just as well with your electric flight packs, maintaining them in a peaked condition while minimizing any negative effects of continuous overcharge.

Finally, be careful about listening to the R/C car guys. They do things to batteries that defy all known logic when it comes to battery technology. They can afford to push to the limit, since their crashes aren't measured in 100-dollar increments. Having your ego bruised when you lose a race is one thing; a severe dent in your wallet is another.

RED SCHOLEFIELD
Gates Energy Products
Gainesville, FL

Thanks for the additional information, Red. The care and handling of Ni-Cds is an elusive subject for most modelers, and I'm sure our readers will appreciate your comments. I agree about being cautious about using the techniques used by car racers, but, by the same token, I think they do have insights to offer—based on hard experience—that shouldn't be ignored. TA



SENSIBLE ONECENT

I really liked the article in your August '91 issue by Mr. Randolph—the one featuring his "Onecent" design. I enlarged the plans to a wingspan of 28 inches so that I could install a High Line IMP-30 electric motor running on three 650mAh cells. The receiver is a 4-channel Futaba with the S133 servos powered by a 9V Ni-Cd battery. All-up weight is 11.5 ounces, and the wing loading is about 1.5 ounces per square foot.

I made a few modifications that might interest others. I reinforced the leading edge with $^1/_{16}$x$^1/_4$-inch balsa strips between the center ribs (instead of gussets). This helps during rough landings. I also added rounded wing tips to increase the wing area, and I reduced the control surfaces by about 30 percent as the plane was "touchy" on the first few flights. This is a perfect plane for small-area flying—easy to build and to repair (if necessary). Thanks a lot!

CLARK A. CALKINS
Walnut Creek, CA

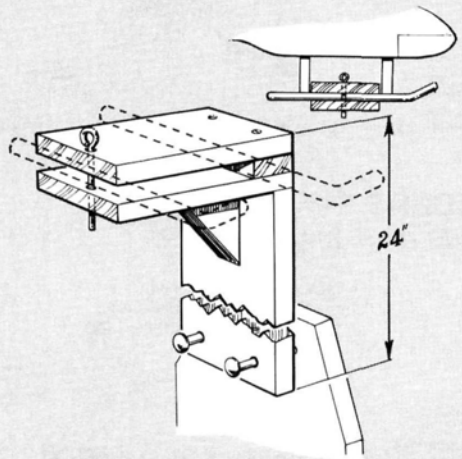
You're welcome, Clark, and you can expect more great "Small Steps"-size designs from Randy Randolph in future issues. Many modelers appreciate the reasonable cost, simple elegance and "flyability" of his designs. TA

We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

HINTS & KINKS

Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman, c/o Model Airplane News, 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we cannot acknowledge each one, nor can we return unused material.

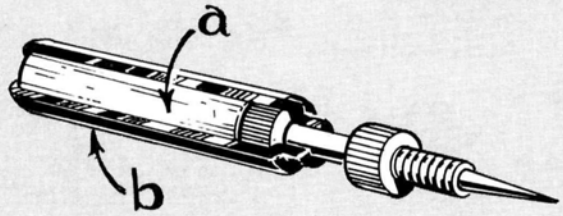
by JIM NEWMAN



CHOPPER SERVICING STAND

This simple stand eliminates much of the bending and kneeling associated with operating R/C helicopters. It's made of 1/2-inch plywood that's screwed and glued together, and it can be clamped onto the end of your field box. The jaws are spaced to fit snugly over the heli skids, which are prevented from sliding out sideways by a hitch pin that's dropped through the hole.

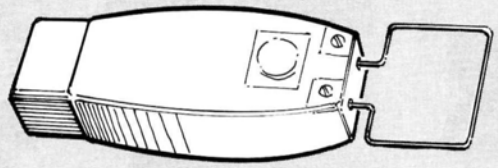
Randy Schmertman, Freeport, IL



NEEDLE-VALVE EXTENSION

Butt a suitable length of dowel (a) against the end of the needle valve—perhaps securing it with a dab of CA or hot glue—and cover the whole assembly with a piece of heat-shrink tubing (b).

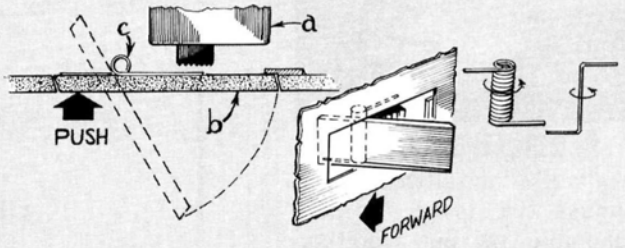
Tony Turley, Dunbar, WV



FOAM CARVING TOOL

A 2-inch piece of nichrome wire secured to the terminals of a cordless soldering iron makes a great hot-wire whittler. It cuts very smoothly, so it's perfect for carving foam plugs for cowls and other complicated shapes.

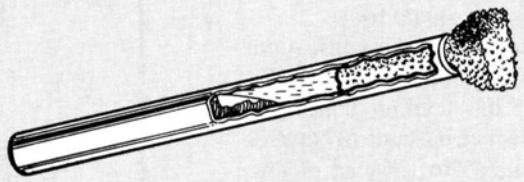
Carl Adkins, Carrollton, TX



SPRING-LOADED CHARGING HATCH

Hide your on/off switch (a) and charging plug under this flush hatch (b). To make the hinge, glue half a Du-Bro nylon hinge onto the door, slightly off-center. Split the other half of the hinge, glue the pieces above and below the first half (to make a three-piece hinge), and use a longer wire hinge pin. The torsion spring (c) can be of the coil or torsion-bar type (at right); glue one end to the hatch and the other to the fuselage. To open, push the forward edge of the door inward.

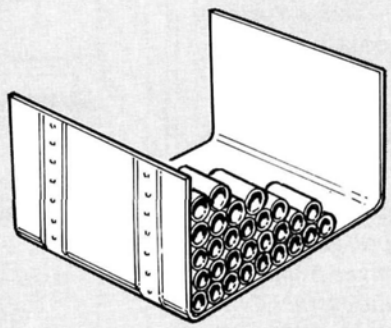
Fred Schmidt, Livonia, MI



SODA-STRAW APPLICATOR

Push a sponge-foam wick into a large soda straw, and then fill the straw with wood sealant, thin paint or any other solution you want to apply in hard-to-reach places. You won't have to keep dipping it like you do a brush!

Shane Guilbeau, Martinez, GA

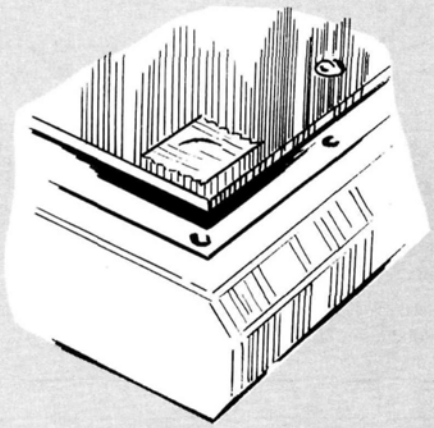


HONEYCOMB RADIATOR

Here's a great tip from the "Fluid Druid" himself! Cut discarded ball-point-pen refills into 3/8-inch pieces, thread them onto a wire and spray them with copper paint. Then glue them into your model's radiator duct. When the glue has dried, paint them once more with a "dirtied" copper wash. This honeycomb radiator would look very convincing on a 1/6-scale (or larger) Curtiss P-6E or Hawker Fury.

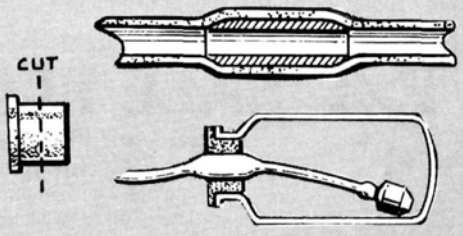
Bob Robert, Durrington, Wilts, England

HINTS & KINKS



AVOID LOSING SCREWS

When you take the back off your transmitter, use a small piece of masking tape to hold the screws in the lid and avoid losing them.

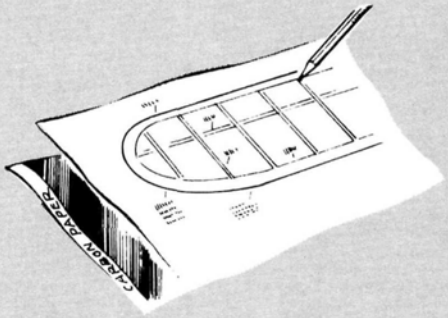


FLEXIBLE PICKUP TUBE

By the time you add a brass tube and a weight to a very small fuel tank (1 or 2 ounces), the pickup tube will hardly move! Slip a $^1/_2$-inch piece of inner Nyrod into the line to make a bulge. (This is particularly important in Kress tanks that have a single large hole in the stopper.) Using petroleum jelly as lubrication, force tubing through the stopper. Cut the stopper as shown and hold it in place with a rubber band.

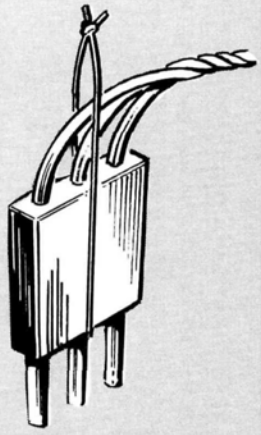
EPOXY-FREE HINGES

Here's an easy way to keep epoxy out of hinges. Cut a small rectangle of the discarded backing from an iron-on covering. Cut a small slit in it so it fits tightly over the hinge, and push it right up against the hinge knuckle. Apply epoxy to the hinge with a toothpick, and then slip it into place. When the epoxy has set, tear out the plastic strip, *then cut a new piece, which you can use when you attach the control surface.*



MIRROR-IMAGE PLANS

If only one half of the wing is shown on your plans, it's easy to produce the other half. Place carbon paper under the plan (carbon side up), trace over the lines, and—voilà!—you now have the mirror image of the wing on the back of the plans.



SAFE PLUG REMOVAL

Removing plugs from receivers by pulling on the leads can cause damage. Instead, tie a loop of fine thread or monofilament around the plug, secure it to each side of the plug body with CA, and then use the loop to pull out the plug.

FUEL FILTER

Cans of fuel often contain dirt or congealed oil residue that can contaminate your fuel tank or airborne filter. To avoid this, first strain the fuel through a "Mr. Coffee"-type filter set in a regular funnel. A staple or two will keep the filter paper folded.

AIR SCOOP

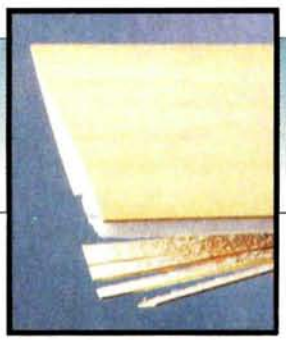
by CHRIS CHIANELLI

New products or people behind the scenes—my sources have been put on alert to get the scoop! In this column, you'll find news that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares?—it's you, the reader, who matters most! I spy for those who fly!

MENACING MESSERSCHMITT

Even as I covered the Nuremberg show for readers (it's where I "scooped" most of the items on these pages), one of the new warbirds now coming onto the market here was taking to the skies. How will the Midwest Messerschmitt acquit itself in the combat for supremacy? We'll have more on this....

CHISELLED IN STONE



All new Robbe kits (and, eventually, the older ones), will have Rhönflugel sheeted-foam wings. This is a new process in which the wings are molded in concrete forms, and the foam and Ayous veneers (somewhere between balsa and obechi in hardness) are pressed together while being heated to produce an incredible bond. The finished wing is stiffer, smoother and more reliable. The highly prefabricated Puma 40 sport plane has Rhönflugel sheeted wings, and it will soon be here in the USA.

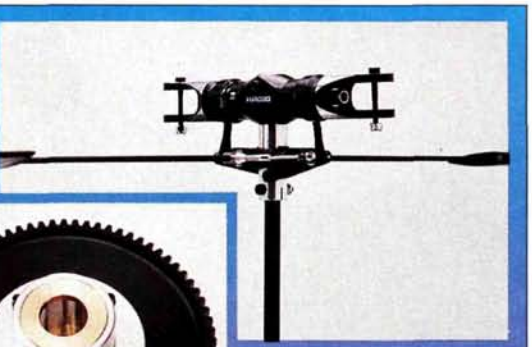
I hope this Kyosho Convert will soon be available Stateside, because they claim it takes a lot of the pain out of learning to fly a helicopter. The tethered, electric-powered model is free to move in any direction, but it's supported and prevented from crashing. According to Kyosho, the Convert can be flown in any room that's large enough to allow the full extension of its flight linkage. Learn to fly on those three-hour lunch breaks; you might as well get *something* accomplished during the day!

HOME HOVERING

ENDLESS FLIGHT BY HERR GRAUPNER

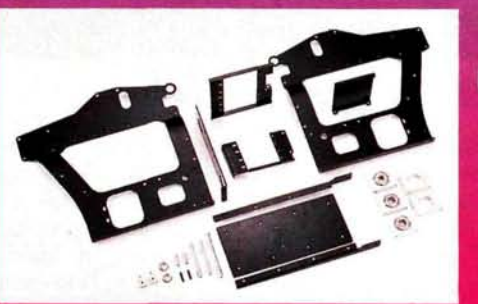
Endless?—well, not quite—but it was as long as you'd ever want to keep your eyes pointed at the sky!

According to the Graupner technical people, under the right conditions (sunny days with thermals to spare), the solar panels on their new Solar UHU give a continuous 1A recharge. I predict that the only complaints we'll hear about the Solar UHU will come from those who are waiting for the frequency it flies on! Yes, that's me on Mr. Graupner's knee; this is a man you don't say "No" to!



HIROBO HARD

Hirobo has introduced 18 machined-metal replacement parts—some in anodized aluminum and others in steel—for the Shuttle. Here's the rotor head with thrust bearing for fast, precise control maneuvers. Also shown are a main drive gear with aluminum autorotation housing and a main side frame for better engine cooling and increased stiffness.



FIFTY YEARS AGO

PAGING ALL MODELERS! BUFFALOES IN THE SKY!

by BRENDA J. CASEY

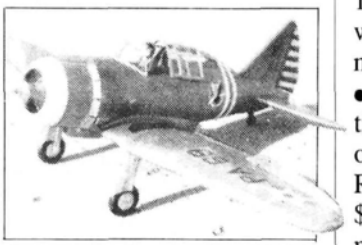
FROM HORSE-DRAWN carriages to custom car bodies, James Brewster did it all! By 1934, his company had branched out into airplane design, and in 1941, it came out with Model 439—a single-seat, pursuit monoplane nicknamed the "Buffalo." *MAN* said it was "one of the fastest, most compact, maneuverable and rugged ships of its class," and it seemed well-suited to high-speed interceptor work.

One of the USA's most heavily armed fighting ships, the Buffalo had two 50-caliber, Colt-Browning, synchronized nose guns that each fired 500 rounds and two 30-caliber machine guns in each outer wing panel. All this fire power was controlled by a single trigger in the cockpit. There, high atop the fuselage's midpoint, the pilot had maximum visibility and was protected by a 3/4-inch-thick, bulletproof, Plexiglas windshield.

The Brewster Buffalo was almost 12 feet high, more than 26 feet long and had a 35-foot wingspan. Including ammunition and fuel, it weighed 6,840 pounds. Powered by a Wright Cyclone 9-cylinder engine with a two-speed blower, the plane had a range of 650 miles, a 310mph cruising speed and a 335mph top speed. With a landing speed of 74mph, this ship definitely *wasn't* for inexperienced pilots!

MORE THAN CHILD'S PLAY

In 1941, modeling was heralded as the "open Sesame" to a career in the nation's aircraft factories. More than 200 hobbyists were employed at labs at Langley Field, VA, and many others were enrolled in flight school or working for the major manufacturers. *MAN* encouraged its readers to "further the defense of America," and its monthly "Original Design Contest" was a way to stimulate valuable new ideas. The winner in May 1941 was an unusual, yet practical, little autogyro with a unique boom tail, twin rudders and a pusher prop that allowed excellent forward vision.



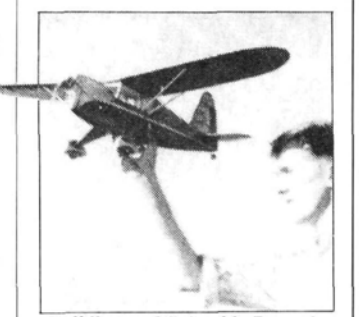
Details, details, details—this 48-inch model Seversky P-35 had them all, including a miniature, 14-cylinder Pratt & Whitney engine and hinged cowl flaps!

Other readers' creations included a 30-ounce, 40-inch-span hydro biplane gas job and a Curtiss P6-E Hawk with an impeccably detailed cockpit and an exact-scale Hamilton Standard controllable-pitch prop. There was also a 48-inch-span, 4 1/4-pound Seversky P-35 pursuit ingeniously built from pictures, not plans. It had 11,000 pieces, and although it took 2 years to build, it could be taken apart and reassembled in 3 hours. The model's landing gear, tail wheel, cowl flaps, etc., could all be operated from the cockpit.

NEWS FLASHES

What was the biggest full-scale aviation news in 1941? The U.S. had finally met its goal of building 1,000 planes a month! There were other notable developments, too:

- In Congress, debate continued over the fortification of Guam when President Roosevelt asked for $4,700,000 to establish a naval air base there.
- Henry Ford was planning a $50-million Douglas Bomber plant with a mile-long final assembly line. The airplane and engine factories would be bomb-proof with 22-inch-thick concrete roofs and tunnels.
- To meet the demand for more heavily armed and better protected U.S. ships, the newest version of the Flying Fortress—the Boeing B-17E—was to have a power turret, armor plating and self-sealing fuel lines and fuel tanks.
- Many companies were getting in on the newest trend—jet propulsion—which added 20 to 25mph to an interceptor's speed. Lockheed planned to use a narrow exhaust tail pipe to give its Excalibur a "rocket boost."



Building and flying his Rearwin Speedster could have helped Edward Naudzius become one of the 5,195 men who entered the aviation industry every week in 1941.

WHICH SIZE SPEEDSTER?

The Nationals-winning Rearwin Speedster was a realistic-looking, rugged model with a stable climb and a flat glide. It had four great features: a long fuselage, an in-line engine, a large vertical tail and a folding prop that increased duration. The full-size plane was powered by a Menasco 125hp engine, but it had a maximum speed of 150mph; the rubber-powered model weighed approximately 7 1/2 ounces, but it still managed consistent 90- to 120-second flights. In 1941, many modelers were making the move to full-scale aviation, but if you couldn't fly *one* Rearwin Speedster, you could build the other! ■

SPORTY SCALE

TECHNIQUES

by FRANK TIANO

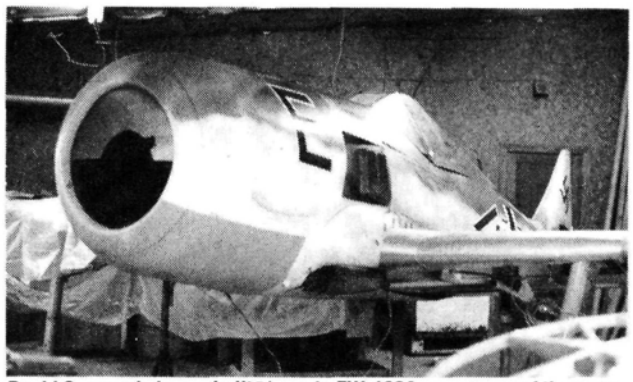
Full-size finishes, gyros and decals.

GOOD AFTERNOON. As I write this, it's an absolutely beautiful afternoon—perfect flying weather (75 degrees), a few white puffy clouds and a 3-knot wind right down the center of the runway! That's what it's like down here in Florida today now that winter is loosening its grip on us. I hope you're enjoying the same. This unusually warm weather has allowed me to get a lot of things done, such as test-flying a couple of new airplanes and bench-running a few new engines. If, however, you're bogged down in cold weather, I imagine you're at the building board trying to accumulate a supply of scale airplanes for the next crashing season! Well, enough small talk; let's see what kind of trouble I can get into this month.

This flier must be seen in color to be appreciated! Unlimited racing may have arrived. For full details and a rules package, write to the address at the end of the article.

A STEP BEYOND

This month, I've been in touch with two modelers who are in the process of applying an authentic paint scheme to their full-scale aircraft. Dave Voglund (of Kentucky) is getting ready to apply paint to his new T-6, and Dave Spencer (of Martinsville, VA) has already completed most of his Focke Wulf 190A! Yup, that's right; Dave Spencer scratch-built his very own 7/8-scale FW-190A, and he thoughtfully sent me a few pictures to share with you. (If you'd like to document a scale model of Dave's scale model, his address is at the end of this article.) Dave did a lot of research to get the colors right and, other than installing the parting ring around the cowling, the airplane looks almost complete. (He has promised me some pictures of the FW on its maiden flight.) I love to see a modeler do a full-scale subject, especially when he has taken the time to do it right. Speaking of Focke Wulfs, I thought you'd like to see one of the neatest, most unusual color schemes ever tested on any airplane, anywhere, at any time. Remember, if you like this scheme, cut it out of this magazine, or make a copy of it and use it for documentation. Any published source can be used as proof for your documentation portfolio.



David Spencer's home-built 7/8-scale FW-190A uses many of the same materials that a giant-scale model would use—fiberglass cloth, epoxy resins, builders' foam, masking tape, Zap, epoxy paints and more. Much more!

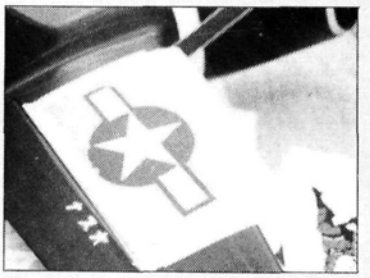
Many years ago, when I lived in upstate New York, one of my dearest friends was Jerry Pulio. He had a knack for finding bizarre color schemes for his competition airplanes, but one was truly beautiful—an experimental color scheme for desert warfare applied to a high-altitude fighter. No, I don't know why the scheme was introduced, but I do know that it's one of the prettiest long-nosed Focke Wulfs that you'll ever see. I'm doing further research, and I have a lead on a photo of this aircraft. When I get it, I'll print it here so that we can all benefit. For now, since the rules don't require a photo of the subject aircraft, this is all you need for color documentation.

RUDDER ONLY

With all the stuff going on about whether or not a gyro should be allowed in a scale model, I'd like to throw in my 7 cents' worth. First, regardless of how many articles you read, you can't become a true gyro expert until you use one. In a nutshell: a gyro on a rudder will help keep your model's tail from wagging, which is to be expected from a swept-wing aircraft or one with a long tail moment coupled with a high-aspect wing.

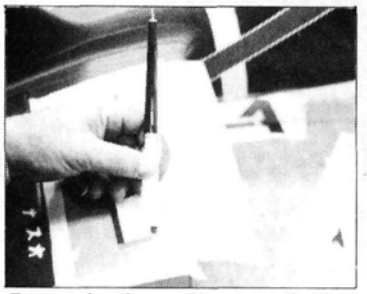
A gyro will *not* help you much in a crosswind, because it needs abrupt changes for it to give a correcting command. In a crosswind, the entire model is pushed either inward or outward, and the gyro can be of no practical use. Yes, it will help straighten take-off rolls, *if* there's little or no crosswind. In a crosswind, the gyro can only help keep you on a track that's *parallel* to the original intended path. In other words, if your airplane swerved drastically off the runway's center line, and you chose not to correct with rudder input, the gyro would only bring the airplane back on a line that's parallel to the original one.

AEROLOFT DECALS



Use the window cleaner to wipe off all the greasy fingerprints; then dry the area completely with a soft paper towel. With its protective paper still intact, place the design on your model. Tape the marking into place.

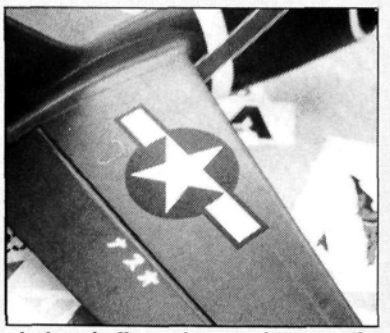
If one picture is really worth a thousand words, then several should be worth an entire book, right? Well, today, right here, on this very stage, we're gonna show you exactly how easy it is to apply those creative markings from Aeroloft*. Please, after this, no more phone calls. There's nothing to be intimidated by; these designs are so easy to apply that even your friends who build with a knife and fork would be hard-pressed to mess them up!



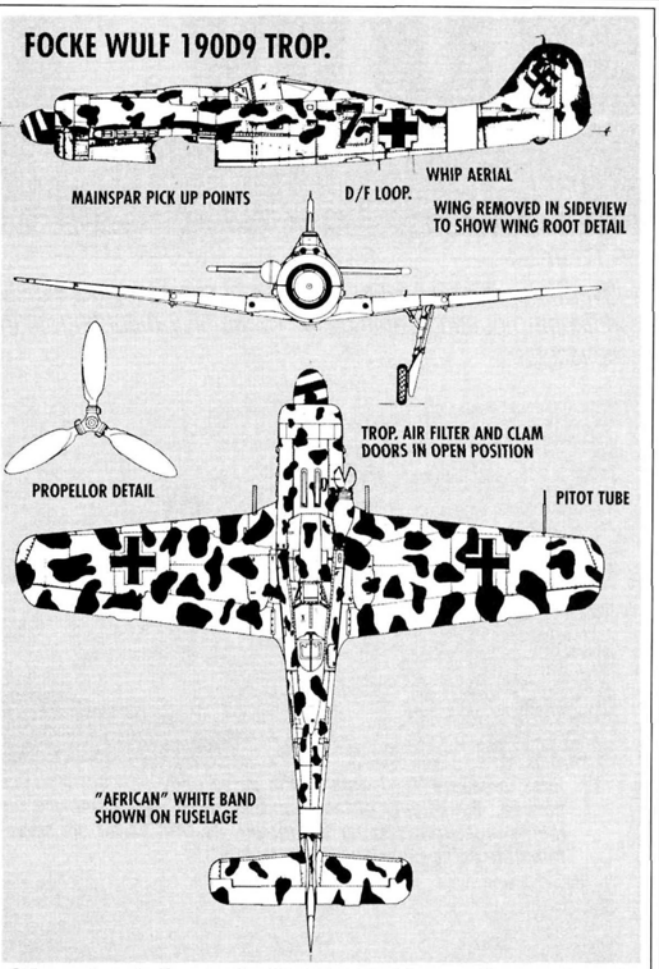
To transfer the marking, use the burnishing tool and rub the entire marking firmly. (Rub just hard enough to make the transfer; don't dent the surface!) I usually rub in one direction; then I follow through with a complete pass in the opposite direction.

Assuming you have your specialty markings from Aeroloft in hand, all you'll need are a few simple tools and supplies. Get some window cleaner, some soft paper towels, some good masking tape and one or two burnishers, like those offered by Zipatone (available in most art supply stores.) Oh yeah, it helps to have your airplane on hand, too!

One last thing: to protect Aeroloft's designs from raw fuel, apply some sort of clear topcoat. Try it on a sample first, and then, if everything is compatible, apply a light coat. Let the first clear coat dry for about 10 minutes until it's tacky, and then apply a second light coat. Wait a few minutes, and apply a third, final coat. Go easy!—a heavy coat of clear can damage the markings. The same procedure will work on an open fabric framework; just take your time.



Just peel off your tape, and remove the cover sheet from the marking. Presto, you've finished.



A three-view of a "tropicalized" FW-190D9. The overall color scheme is sand with black and green blotches. The light-blue bottom color creeps up the fuselage sides to just under the fuselage national marking. The propeller color is also no.71.

It can't make the model do a few S-turns to get back to the center line. Remember: *a gyro will only work if you have the nerve to let go of the rudder stick and let it do its work.* Once you've touched that rudder stick, you've overridden the gyro!

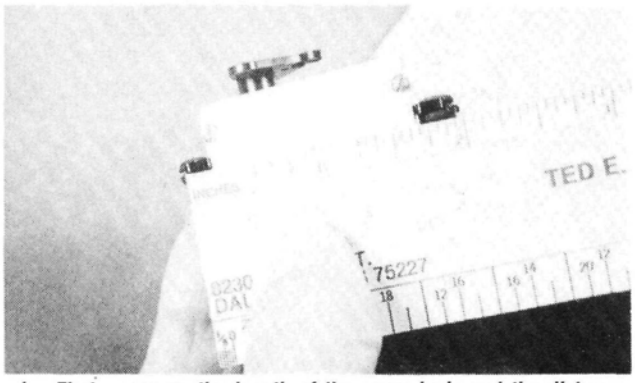
I don't know who was behind the movement to ban gyros from scale competition, but I think they were seriously misinformed. This is the '90s. Some full-scale aircraft use gyros to help straighten certain bad flight characteristics. Why not allow scale aircraft to benefit from the same technology? Gene Barton sent out survey forms (at his own expense) to get a feel for how competition pilots felt about gyros. To make a long story short, of 160 modelers polled, 90 percent were in favor of gyros on rudders, 5 percent favored the use of gyros on every control surface, and the other 5 percent thought they should be banned! I agree that putting a gyro on other surfaces, such as elevators or ailerons, could give a pilot an edge, especially in low-G maneuvers like flybys, figure-8s, traffic patterns and other level maneuvers. I also agree with Gene that a gyro or rudder should be allowed, if for no other reason than that it's far safer to have one than not to have one! Comments anyone?

HOW TO:

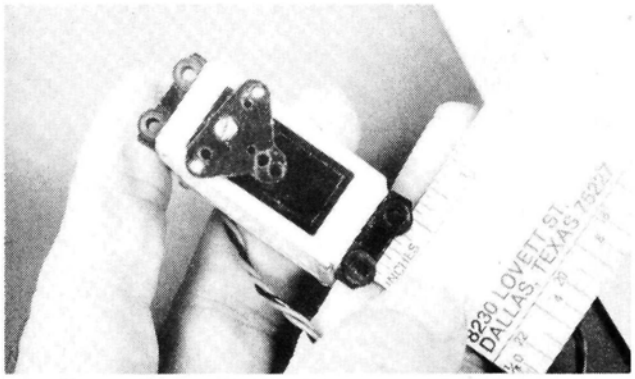
by RANDY RANDOLPH

MAKE SERVO-MOUNT TEMPLATES

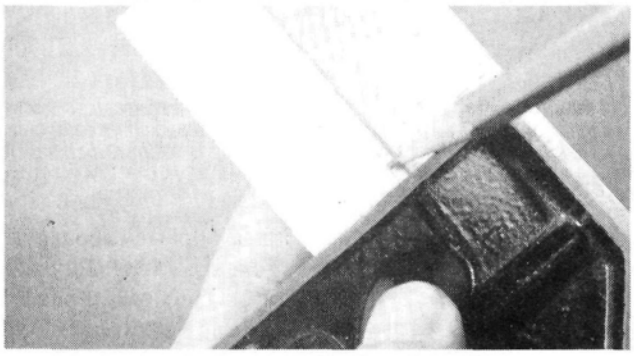
Over time, most modelers accumulate servos from a variety of manufacturers. Because the servos differ, they usually require different mounting parameters. To simplify mounting, the photos show you how to make a template for each servo in your collection.



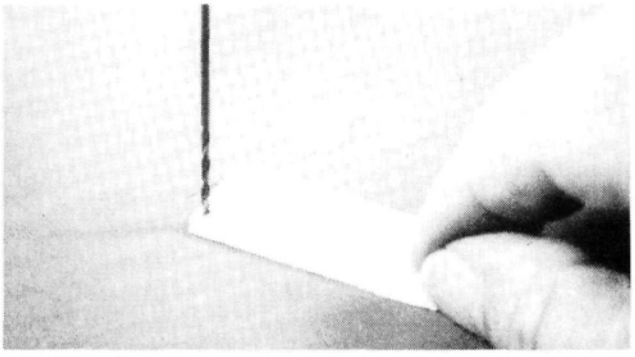
1. *First, measure the length of the servo body and the distance between the centers of the mounting holes. This gives you the inside measurements for the mount, as well as for the servo-template guide (which you'll make later).*



2. *Measure the overall width of the servo and the distance between the centers of the mounting holes on each end. If the servo arms extend beyond the sides of the servo, measure them, too.*

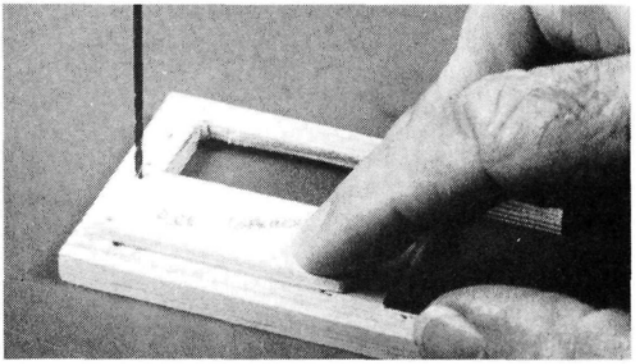


3. *Use a square to mark the outside dimensions of the servo case on a scrap of 1/8-inch plywood (which will become your template). Allow at least an extra 1/4 inch at each end for the mounting holes.*



4. *Using the measurements, mark the positions of the mounting holes on the template. Be sure to drill them at exactly the same distance from the case outlines drawn on the ply template as they are from the edges of the servo itself.*

5. *Using your servo-case measurements, make a guide block out of scrap 1/4-inch balsa sheet. Center the guide block inside the marks on the ply jig, and glue the two pieces together.*



6. *Label the template for the servo it represents, and use it just as you would the servo to position and drill the holes in the mount. If you use plywood or hardwood cross-fuselage mounts, the guide on the back of the template makes it easy to position them correctly.*

PILOT PROJECTS

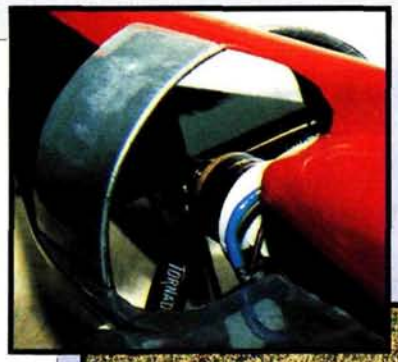
A LOOK AT WHAT OUR READERS ARE DOING!

SEND IN YOUR SNAPSHOTS!

MAN is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1991. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in !

Send those pictures to:
Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.



ELECTRIC FANTRAINER

At first, we thought, "Oh, another 1/2A Fantrainer built from *MAN* plans," but then we realized that this one had an Astro cobalt .05 stuffed into its shroud! David Patricoski of Glendale Heights, IL, "electrified" our plans' design, enlarged the plane's wing area by 10 percent and came out with a real winner. It's finished with Mono-Kote, and it uses eight 800 or 900mAh SCR cells for power. David says it makes 3-minute flights with speeds approaching 100mph! After a strong hand-launch, he says, "Watch out!"

HE HAS THE SUPER HOTS!

Here's an O.S. .60 long-stroke-powered Super Hots built by Dewitt Barham of San Diego, CA. This 54-inch-span plane is finished with Super MonoKote, and it sports wheel pants from a model Cap 21. Its fuselage is 51 inches long, and its wing area is 702 square inches. Spinning an APC prop, its flights are "snappy!"

STORCH IN DISGUISE

R. Peereboon Voller of Veenendaal, the Netherlands, modified a Svenson kit of a Fieseler Storch and built this 1/6-scale Morane Saulnier MS 500 Criquet. Painted in WW II guise, it has a 2.37-meter wingspan, a fully detailed cockpit, functional navigation lights and a wing light. Powered by an O.S. FS 120 Surpass 4-stroke engine,

MONSTER MOSQUITO!

This monstrous FB VI is the handiwork of Haest Ronny of Tienen, Belgium. Haest enlarged Brian Taylor plans to 1/6 scale, making the wingspan 102.26 inches. Powered by two O.S. 120 Surpass engines, the model is impressive in flight. Haest covered it with paper and dope and finished it with enamel. Its all-up weight is 26.4 pounds. They build them big in Belgium!

DELIGHTFUL DISCUS

Colin Gentry of Caryville, TN, sent us this photo of his 1/4-scale Discus sailplane. Colin compares the quality of this Graupner kit to that of a Swiss watch. The plane's wingspan is more than 13 feet (4 meters), its wing area is 1,162 square inches, and its fuselage is 65 inches long. Colin controls the plane with a Futaba radio, and he uses an electronic "thermal sniffer" to extend his flying time. He also built an 8x2x2-foot field box that he put on top of his car to transport the beast!

SIMITAR SQUADRON COMMANDER

Homer Gibson of Ripon, WI, built this Simitar Leading Edge .40 from a Bill Evans' kit. The 50-inch-span model is powered by a Fox .50. Homer is 80 years old, and he likes to fly fast. His favorite expression is, "If I'm flying too fast, dial 1-800-EAT-MY-TURBULENCE!"

SUPER ELECTRIC 38A

Nelson Whitman of E. Falmouth, MA, poses with his fabulous Sikorsky S-38a—a passenger carrier used by Pan American Airways in 1928. This scratch-built, 1/10-scale, 11-pound model has an 84-inch wingspan and a 1,037-square-inch wing area. It's covered in micafilm. Operated by two Jomar speed controllers and powered by two 15-cell 900 SCR packs, the twin Astro cobalt 25s spinning 9x4 props should make this model perform.

WHAT IS AN "IBIS"?

An "IBIS" is this 41-inch-long pusher/canard plane that was designed and built by Nicholas Agneta of N. Bellmore, NY. It has a 60-inch wingspan and a 26-inch canard span, both of which have modified Clark "Y" sections. The IBIS has a 484.5-square-inch wing area and is powered by a Super Tigre .51. Its ready-to-fly weight is 6.75 pounds, and it has a wing loading of 27.4 ounces per square foot. Nicholas has flown this model and says that it does loops and rolls well. After a final re-trim, it flies exceptionally well.

JET BLAST

NOTABLE KITS; TROUBLESHOOTING & CONSTRUCTION TIPS

by GEORGE LEU

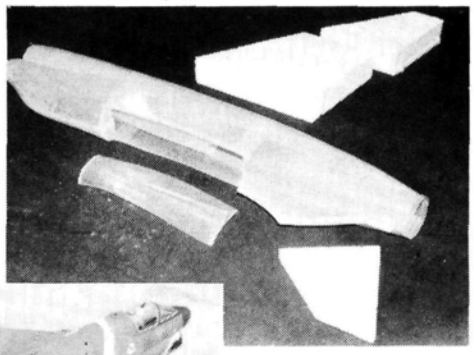
AS YOGI BERRA is purported to have said, "This is like dejà vu all over again." Well, writing this column *seems like* old times for me. The column was initiated by Rich Uravitch, who helped introduce me to R/C fan jets some years ago. In this article, and in future ones, I plan to cover a spectrum of topics involving jets, putting an emphasis on available products and what it takes to get started in this exciting pastime.

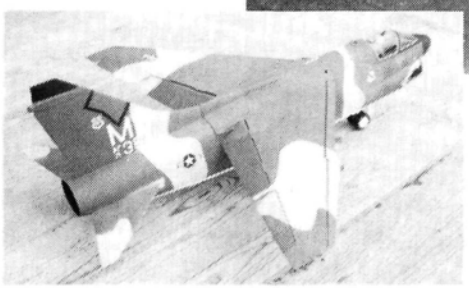
WHAT'S THE FLAP?

The Jet Hangar Hobbies* A-7 shown in the photo is mine, and it took me about 6 months to complete it. I classify it as a sophisticated semi-kit with options to make it a simple sport-scale design for a 4-channel radio. The kit came with an epoxy-glass fuselage, duct liners, foam wings, a foam fin, external and internal ABS plastic parts and, as an option, a complete wood and hardware package. I was impressed with the fiberglassing and the complete set of plans.

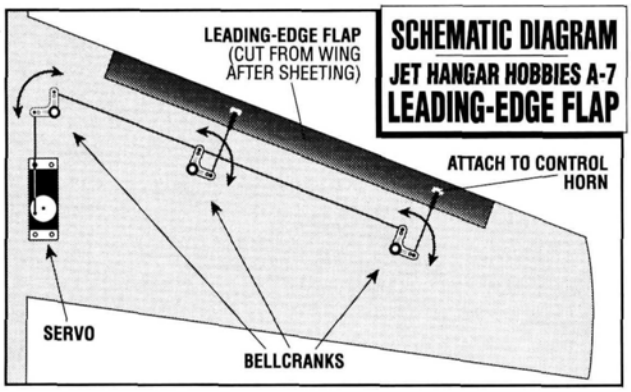
My A-7 had its coming-out party at the 1990 Southwest Fan Fly. I was happy to receive some nice compliments about it from several top fliers, but what really amazed me were the questions about its functional leading-edge flaps. I didn't think of them as a unique feature because the full-size aircraft had them, and this is a scale model of an A-7. If you attended the 1990 Top Gun Tournament in Mesa, AZ, you may have seen Larry Wolfe's JHH F-4 Phantom, which had similar, scale, leading-edge flaps. (He shares his technique for making them on the A-7 plan set.)

Installing a leading-edge flap is no more difficult than installing ailerons. The system is devised around multiple bellcranks that are installed in the wing before it's sheeted (see diagram). All wires, clevises, etc., must be installed before sheeting. Flaps are cut out of the wing and hinged at the bottom. JHH supplied the Air Force decals, and Scale Model Research* provided the documentation. My hat is off to JHH for this excellent kit; I sold my first A-7 and am now working on a second one (Navy version).





Right: the A-7 primary kit parts laid out. Below: the author's A-7 in camouflage dress.



FLIGHT OF THE INTRUDER

Have you seen "Flight of the Intruder"? Do you wish you had a jet model of the A-6? Give DCU* a call. This company makes all sorts of epoxy-glass for companies like Accu-Scale, Jet Hangar Hobbies, etc. They do a lot of movie work, and that's how they developed the kit of the A-6 Intruder. DCU has also acquired the molds for and rights to manufacture the line of Spirit Jets.

The Intruder kit retails for $1,200, plus $300 for shipping. The model has a 10-foot wingspan, and it's approximately 10 feet long (see photo). It has an epoxy-glass fuselage, foam wings, a four-piece canopy, ducting, a complete cockpit, many ABS molds of ECM pods, extensions and much more. The scale size is 1/5.5, and, ready to fly, it weighs 40 pounds on approximately 3,400 square inches of wing area.

Its power system is designed around two Byrojet* units, but the plane will stay airborne on one. For takeoff, it needs about 150 feet of pavement, and it lands at approximately 27mph. It's positively awesome in flight, so if the Intruder bug has bitten you and you're prepared to spend some bucks, here's your chance to make a big, beautiful A-6 Intruder.

TIPS FOR STARTING OUT

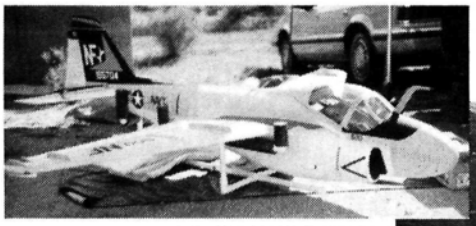
Most entry-level kits can

be flown perfectly well with a standard 5- or 6-channel radio. I recommend the use of retracts, because they minimize drag during flight (although they're optional on some kits). I don't recommend the use of flaps and flaperons on initial construction projects. If you want to add them, that's fine, but they increase weight and are one more function that can go wrong.

Control linkage is of major importance, but it's often overlooked. A typical R/C sport plane may fly at up to 80mph and at around 100mph in a dive. Servo loads remain fairly constant. If the pushrod is too long, it may bow under the extreme counter-pressures endured, e.g., in a dive, and this will result in a slower response to control inputs.

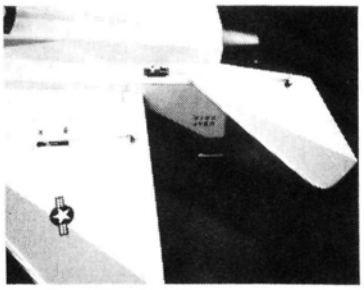
The typical jet-model plane flies at approximately 120mph, and it exceeds speeds of 150mph in a dive. One can imagine the stress placed on the servos. Jet designs usually incorporate a way to minimize linkage bowing. There are several methods, but the most common is to move the servo close to the control surface to minimize the distance from the servo to the control horn (see photo). It virtually eliminates bowing, and you can use just the clevis wire without the need for a longer pushrod.

If you're building your own design, you can use an alternative method: put Styrofoam in the fuselage, on top of and below the pushrods to restrict their movement. This method has worked for years on pattern ships with long fuselages, and it lends itself well to jet designs. If you use pushrods that run through tubes, it's best to bond the outer tubes to the fuselage with epoxy at 2-inch intervals.



The big A-6 Intruder on display at Top Gun '90. Mark Hambleton, owner of DCU, proudly shows how A-6 wings are attached.

Control-surface attachment is also critical for model jet flying, because the high speeds will quickly cause flutter. I recommend that you use extra hinges on all moving surfaces. How many extra? My rule of thumb is that if a sport plane of the same planform uses three hinges, you should use five.



This Regal Eagle by Tony Zaremba (built from a Bob Parkinson kit) shows direct, short, servo-to-control-surface linkage.

In my next column, I plan to cover some of the ducted-fan jets seen at Top Gun '91. Meantime, start sending pictures and comments to my attention, care of *Model Airplane News* (and enclose a SASE if you want a reply). Until next time, keep those jets flying!

**Here are the addresses of the companies mentioned in this article:*

Jet Hangar Hobbies, *12130 G Carson St, Hawaiian Gardens, CA 90716.*

Scale Model Research, *2334 Ticonderoga Way, Costa Mesa, CA 92626.*

DCU, *1556 S. Anaheim, Unit C, Anaheim, CA 92805.*

Bob Violett Models, *1373 Citrus Rd., Winter Springs, FL 32708.*

OPS; *distributed by Shamrock Competition Imports, P.O. Box 26247, New Orleans, LA 70186.*

McCoy; *distributed by Bob Violett Models, 1373 Citrus Rd., Winter Spring, FL 32708.*

Rossi USA, *214 Harvest Ave., Staten Island, NY 10310.*

Metalon, *distributed by Bob Violett Models and by Yellow Aircraft , 11919 Canyon Rd. East, Puyallup, WA 98373.* ■

BASIC FAN-JET TROUBLESHOOTING

Here's some plain common sense, but you'd be amazed at how many fliers at jet rallies are frustrated because they arrived poorly prepared.

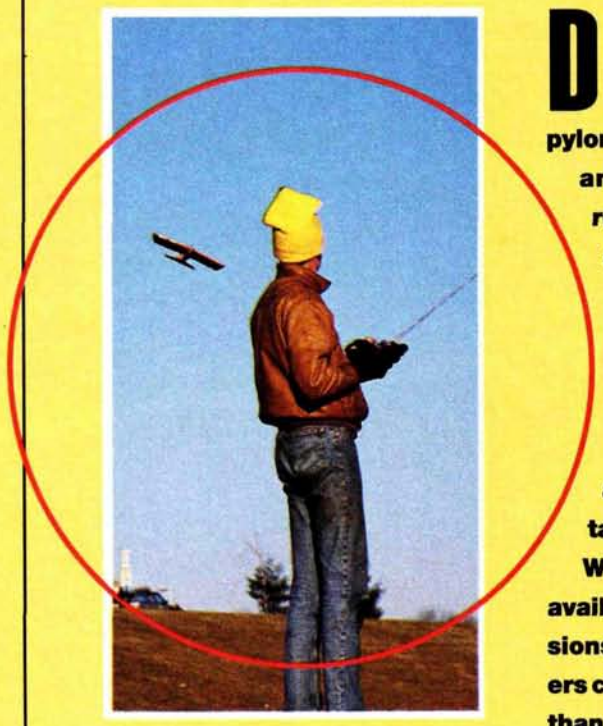
- Use a good glow plug such as the OPS* 300, the McCoy* 104-9, or the Rossi* no. 6, no. 7, or no. 8. The length of its life depends on the nitro content of your fuel and on the rpm generated by your engine. Unfortunately, five flights on a plug is considered a long life.
- Use a high-quality fuel, such as Byron, K&B 500, or Mach 7 jet fuel. Don't use sport fuels with additives—use *jet* fuel. Unless the fuel contains only pure ingredients, the higher temperatures and rpm of fan engines will break down lubricants. To avoid this, I add a capful of Metalon* to all my jet fuel.
- Don't go overboard with the nitro in your fuel. Too little preserves glow plugs but causes inconsistent idling. Too much can burn up everything in the engine, including the piston head. Shimming the engine head by a few thousandths of an inch may allow you to use more nitro for good idling, yet prevent detonation problems on the piston-head surface.
- Cooling is very important to successful engine operation. Make sure there are no obstructions that might prevent the engine from receiving enough air to cool off.
- The constant vibration associated with the engine/airframe causes friction between parts. This can result in loosened parts and pinhole leaks in the fuel tubing. Preventive maintenance, including diligent pre- and post-flight checks, is important, particularly with ducted-fan models.

PHOTOS BY YAMIL SUED & DAVID BARON

EZee Wizard

A 7-cell racer that's easy to build and fly

by DAVID BARON



Dave Baron flies EZee Wizard on overhead approach.

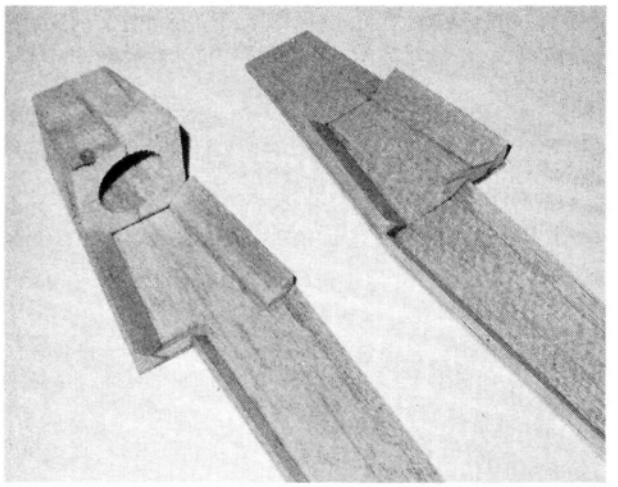
DURING THE PAST YEAR, we've seen a lot of advertisements for electric pylon racers. Their smallness and convenient use of regular R/C car batteries and chargers means that they're potentially a lot of fun. Other obvious benefits include their silent operation and the excitement they generate when two or more take to the pylons.

What's the drawback? The available kits and ARF versions of these desirable racers cost a lot; many cost more than a good radio. Motors are expensive, too, but when you consider that a good cobalt 05 swings the same prop as a

gas 15 and rivals it in power, you're really getting a lot for your money. Also remember: no more glow plugs, fuel, electric starters, messy exhaust and having to steal glass cleaner and paper towels from the kitchen...!

BEHIND THE DESIGN

The Wizard was designed to be easy to build and fly, inexpensive and rugged. When someone flies it for the first time, I often hear the comment, "It turns on a dime without tip-stalling"—and it does. The reason for this lies in the design of its wing. Designed by John Florio (of Florio Kit fame), this airfoil gives the best possible speed range. Electric aircraft aren't known for their lightness, so we have to take advantage of airfoils that can generate high lift at lower speeds. I never forgot, though, this was to be a pylon racer, so I combined a proven airfoil with a generously swept and streamlined wing. The result is a racer that hugs the pylons and flies out of a turn as fast as it entered it, yet slows to landing speeds that few trainers can match.



The engine mount is test-fitted to the fuselage side before it's glued into place.

The EZee Wizard approaches for a close flyby.

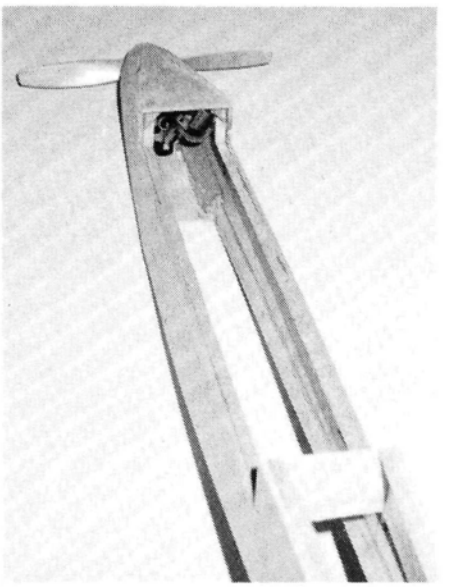
WIZARD

SPECIFICATIONS

Type: *Electric pylon racer*
Wingspan: *34.75 inches*
Wing Area: *360 square inches*
Wing loading: *14.5 ounces per square foot*
Chord: *10.25 inches*
Length: *34 inches*
Weight: *34 to 38 ounces*
Power Req'd: *Astro 05 Cobalt or FAI 05 motor recommended*
Batteries: *7, 900mAh, 8.4V SCRs*
No. of Channels Req'd: *3 (rudder, elevator, motor)*
Prop: *Graupner 6x6 folding (for racing)*
Radio: *Futaba* 4NBL Attack recommended*
Comments: *as much a sport plane for small-field use as it is a pylon racer that's capable of tighter, high-speed turns than similar aircraft in its class.*

If you've already peeked at the plans, you may have noticed that the Wizard has no ailerons. In case you feel this insults your flying ability, consider that a racer needs to keep drag to a minimum, so fly the Wizard as it's shown on the plans before you consider adding ailerons. It even rolls well and flies inverted on rudder and elevator without any special control inputs.

Landing gear is also missing from this design. Though the reason for this is obvious, my favorite challenge to other pylon racers is a "touch-and-go race." I use a Graupner* 6x6 folding prop, and I bounce the plane's belly on the grass with its airspeed just slightly more than a normal landing speed. You might call it a "hot" touch-and-go. Just remember that you can't turn the power back on until you have sufficient prop clearance!



The motor and mid-fuselage former (aft of the battery compartment).

WIZARD CONSTRUCTION

• **The wing.** The wing is built in one piece with no dihedral, and for strength, it's important that your center sheeting is just one piece.

Cut out the sheeting according to the plans. The leading-edge (LE) sheeting is all 3 inches wide; the trailing-edge (TE) sheeting measures $^1/_{16}$x$^1/_2$x36 inches, so simply cut one $^1/_{16}$x3x36-inch sheet down the middle, and you'll have enough wood for all your TE sheeting. Cut the ends of the lower sheeting and the inside edge of the upper sheeting at 15 degrees to fit them correctly.

The EZee Wizard performs "hot" touch-and-gos.

WIZARD

Note that the lower LE and TE sheeting only extend to the end of the last rib, and the upper sheeting extends to the outline of the wing tip.

Please *don't* attempt to modify the wing tips. First, try it as shown on the plans; you'll find that no other pylon racer will "out-turn" the Wizard.

Cut out 13, 1/16-inch-thick ribs (six left, six right and one center). Notice the 15-degree angle that's filed into the notches in the 1/4-inch spar so that the ribs stay at the proper angle to the swept spars and the LE.

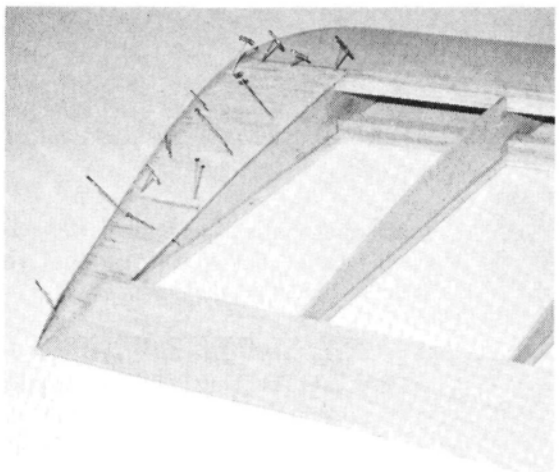
Working from front to back, pin down the LE, then butt the LE sheeting up to the LE. Glue with thin CA, allowing it to wick into the joint. Next, glue in the center sheeting and the capstrips according to the plans. Finally, glue the TE sheeting. Trial-fit the lower spar and ribs, and when you're confident that everything fits properly, wick-in the glue. Glue in the upper spar at the center section. Cut away part of the center rib to accommodate a piece of scrap 1/4x1/2-inch LE stock, which will fill the areas between the first two bays (see photo).

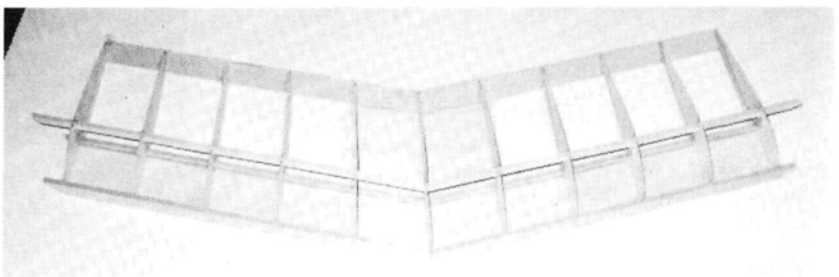
Don't take the wing off the building board yet, but if the glue on the assemblies has dried, take the pins out of areas that will be covered by the upper sheeting. Fit and glue the leading and trailing upper sheeting and capstrips. (The TE is formed by the upper and lower sheeting.) Remember that all upper sheeting extends to the edge of the wing tips.

When the glue has dried, take the wing off the building board, and carefully sand the wing tips to the proper angle (in "Wing-tip detail" on the plans). Glue the 1/16-inch cap plate to the underside of the wing tips, then sand the wing.

• **The fuselage**. The sides of the fuselage are cut out of one piece of 1/8x3x48-inch balsa. When you cut them out (following the outline shown on the plans), don't remove the section where the wing sits until you've glued in the triangle stock all the way around the edge of the fuselage sides, the wing saddle and the bulkhead supports. As usual, be careful to make one left and one right fuselage side. Note that 1/2-inch triangle stock is used forward of the wing, up to the back of the motor mount, but all the other triangle stock, including the wing saddle, is 1/4 inch.

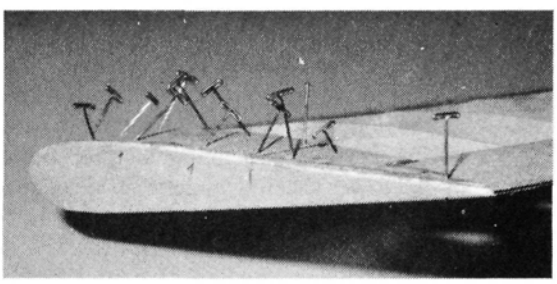
Cut out a rectangular section where the wing sits, and save the pieces, with the triangle stock, for later. To define the canopy and fairing contours, trace the rib

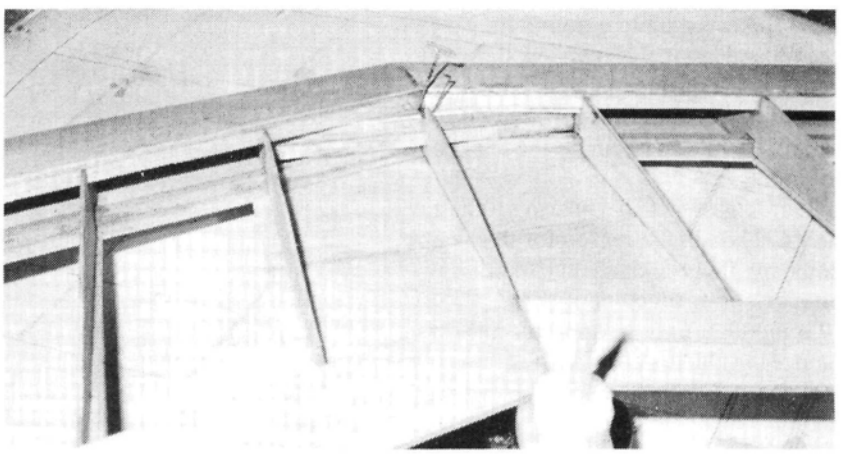


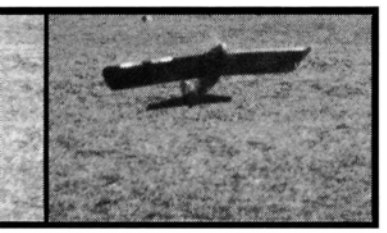


Above: The wing under construction. Below: A center-section wing detail. Note the absence of shear webs or fiberglass. The Wizard has cartwheeled without suffering structural failure.

Above and below: This wing-tip detail shows the attachment of the upper planking.







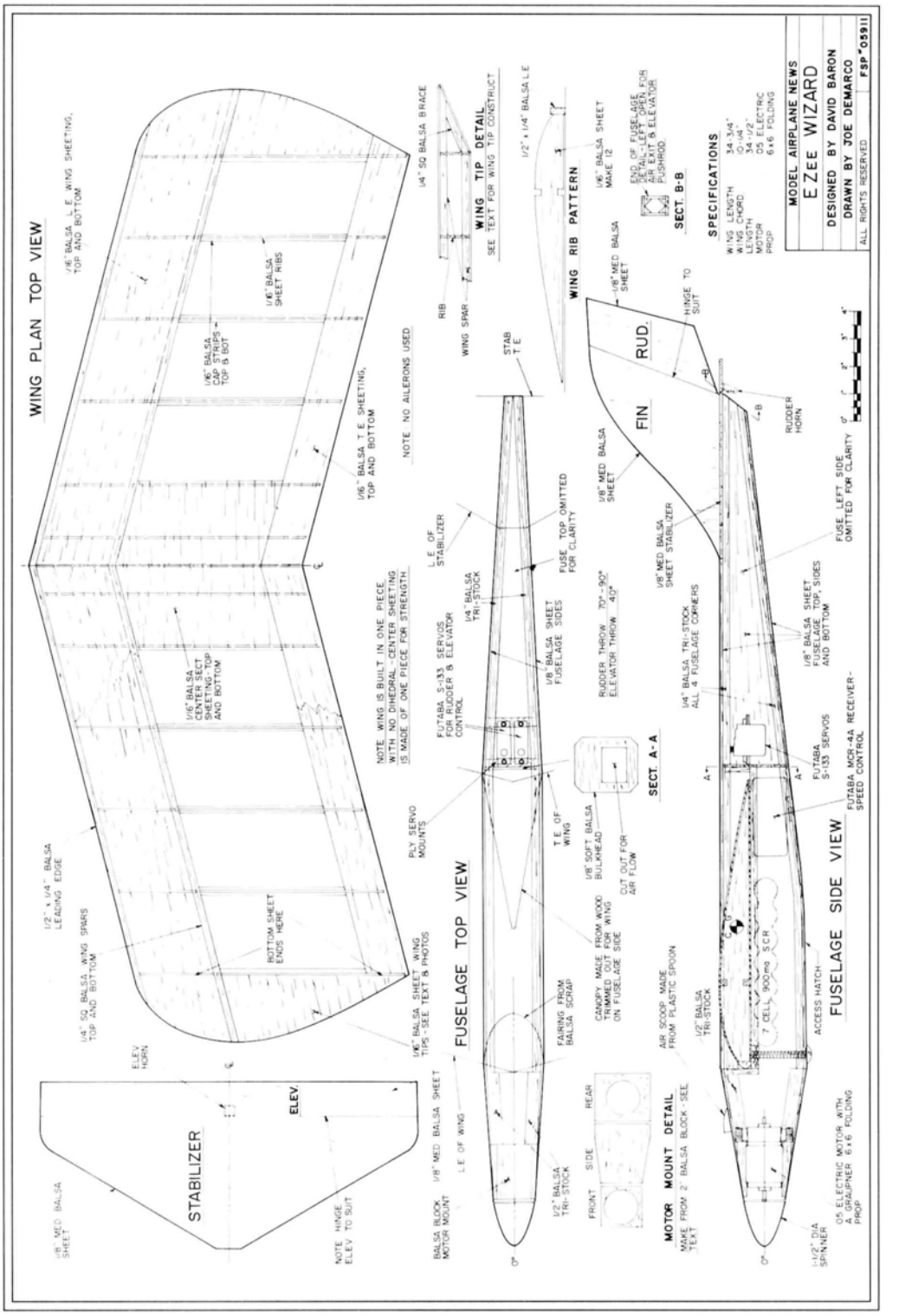
pattern onto each rectangular cut-out. (You'll use them to make the canopy and LE fairing after you've glued the wing to the fuse.)

• **The motor mount.** Start with a 2-inch cube, with the center lines marked on all sides. The grain will be positioned to run lengthwise along the plane, as it does on the fuselage sides. Using a hole saw with the same diameter as your motor, drill out the center of the block. (The cut should be in the direction of the grain.) A drill press is the most accurate tool for this job, but I've successfully used a hand drill. If you find that you haven't drilled perfectly accurately according to the center lines you drew on the block, simply adjust your lines. (This is why the block is oversize.) Now cut the outer edges of the block to fit the plans.

Trial-fit the motor in the mount. Verify that the motor's center line is parallel to the lines on the bottom, top and sides of the motor block. Test-fit the block against the fuselage sides. It's helpful to have the center line drawn on the inside of the fuselage sides. When you're satisfied that the block fits tightly against the triangle stock and is accurately positioned for zero degrees downthrust and zero degrees right thrust, apply glue liberally.

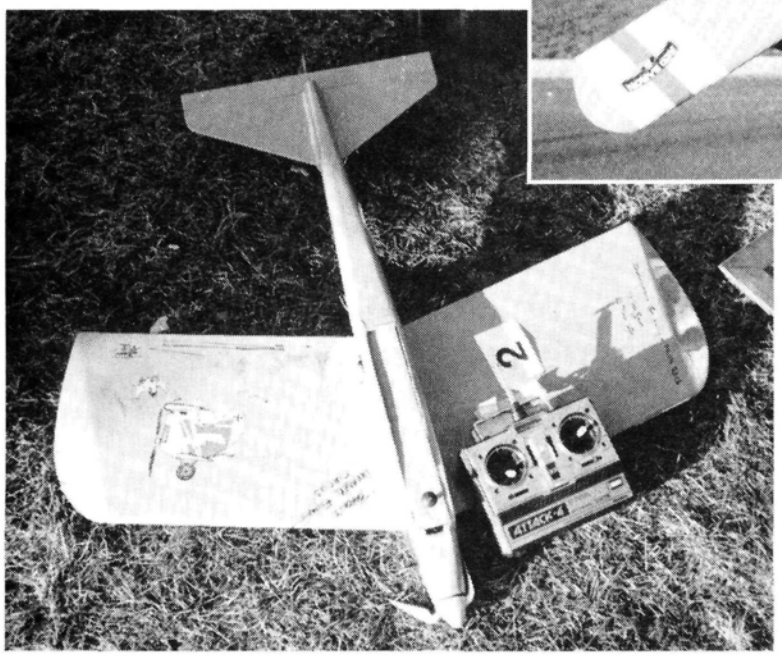
Pin the tail pieces together to ensure they're correctly aligned (don't glue). Test-fit the fuselage bulkheads, but before you glue them in, test-fit your radio equipment and your motor/power system. Your choice of speed controller, battery and servos might not look at all like what's on the plans, so take the time to lay out your system carefully.

Pin the rudder and stabilizer into place, and check the center of gravity (CG). There's no allowance for nose weight or tail weight in an electric racer, so position the equipment to obtain the correct CG.



WIZARD

David Baron with his EZee Wizard. Note its streamlined canopy.



The installed battery pushes the underside hatch flush with fuselage. A nylon bolt secures the hatch front (a tab at the rear of the hatch keys into the fuselage) and prevents the battery from moving forward during a hard landing.

Next, install the bulkhead. Use masking tape to hold the fuselage halves together at the rear while you install the stab, the rudder, the radio and the pushrods. The rudder requires a substantial amount of throw: 35 to 45 degrees in each direction; but the elevator requires less: start at 20 degrees in each direction. When you've installed the radio, sheet the bottom of the fuselage. Your choice of hatch and hatch cover location will depend primarily on which radio and power equipment you choose. To reduce weight, save time and increase strength, I don't use a hatch over my servo tray.

Test-fit the wing into the fuselage. The LE should rest against the forward edge of the saddle. Check their alignment and then apply glue generously.

- **The canopy and wing fairing.** Sand these before you glue them into place, because you'll damage the wing skins if you sand them after they've been installed. Install an Astro* Cobalt motor and the spinner. You won't need any special hardware to hold the motor in place, because the brushes prevent it from moving forward.

If you use a 540 Series can motor, or if your Astro motor doesn't fit snugly into the mount or wobbles slightly, install a thin plate of 1/32-inch plywood on the front end of the block, and screw the motor into place. On this plate, drill cooling holes to match those on the face of the motor. Check that the face of the motor mount doesn't change your motor thrust line, and trim it as necessary. Mount your spinner, and trace around it to give you a guide for your final sanding of the nose area.

WIZARD WARDROBE

I cover the entire plane with MonoKote* after I've completed the final assembly, because I don't want to risk scoring the wing sheeting with a razor near the center section. (The strength of the wing lies in the sheeting.) Use a bright covering, because this plane flies fast and "gets small" quickly!

FLYING THE WIZARD

The Wizard's shoulder-wing design makes hand-launching easy. You'll need a little right rudder until it's up to its flying speed. If there's enough space, let your Wizard accelerate in level flight for as long as possible. It will greatly increase flight duration and allow the Wizard to fly as fast as possible. The batteries take a lot of strain while your plane is hanging on its prop. (This is the reason for streamlining a racer. Remember that, in all your electric models, reducing drag is as important as reducing weight.)

Select a propeller that matches your flying style. While you're getting used to how your Wizard flies, a 7x4 or a 7x5 APC* prop will provide the best climb and longest flight. Sport flying, light racing and "touch and gos" (described earlier), are best performed with a Graupner 6x6 folding prop, and bloodthirsty racers and speed demons should use the regular (non folding) Graupner 7x6 prop. When you use this prop, take special care to ensure that you'll have enough battery power to complete an 11-lap race. Fly fast and don't cut any pylons, or, even if you led the race until your power died, you might not make it to the finish line. Happy flying!

**Here are the addresses of the companies mentioned in this article:*
Graupner; *distributed by Hobby Lobby International, 5614 Franklin Pike Cr., Brentwood, TN 37027.*
AstroFlight Inc., *1331 Beach Ave., Marina del Rey, CA 90292.*
MonoKote; *distributed by Top Flite, 2635 S. Wabash Ave., Chicago, IL 60616.*
APC; *distributed by Landing Products, P.O. Box 938, Knights Landing, CA 95645.*
Futaba Corporation of America, *4 Studebaker, Irvine, CA 92718.* ■

GOLDEN AGE
OF RADIO CONTROL

by HAL DeBOLT

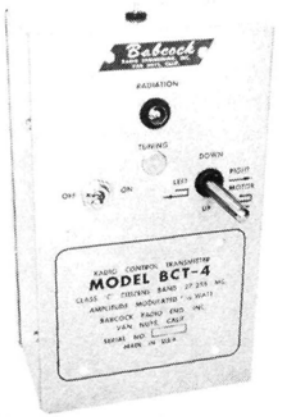
Radio revelations

THIS MONTH, I struck gold! Bob Engelhart of Kings Point, FL, gave me a copy of the September '64 *American Modeler,* and it contained just what I needed to initiate a discussion about Babcock R/C!

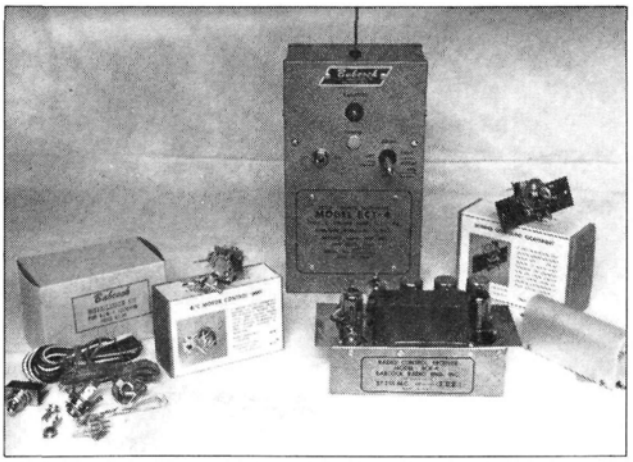
BABCOCK BEGINNINGS

In the '50s, Stuart Babcock operated the Babcock Electronic Engineering Corp. in Costa Mesa, CA. It was a sizeable operation devoted to military production, but Babcock was interested in modeling, so he started a hobby division.

Some of the corporation's efforts were devoted to military drones, for which Babcock had developed an R/C system based on audio-frequency discrimination, i.e., a separate audio frequency for each control function (a concept that was successful). One group of aeronautical engineers had spent more than six months designing and building the prototype, but they had designed it according to "full-scale thinking," and their drone was almost impossible to fly.



The Babcock 3-channel transmitter. Note the stick-movement instructions: up and down were familiar moves; for right, the stick went right; but for left, it went right, then left. To change engine speed, it was moved right, left, released, and moved right again. Interesting?



The Babcock 3-channel receiver of the '50s. See how large and robust the components are? With these, there would have been high-voltage "B" batteries, filament and escapement dry cells—a sizable load for any model!

With modeler's insight, Babcock saw what was needed for a successful "RCAT," as the project was called. He discussed the problem with a leading R/C pilot and designer, Dick Schumacher, and within a few weeks, they had a new prototype RCAT, which performed just as they had hoped it would. Schumacher's design had a 6-foot span, weighed only 13 pounds and was powered by a Fox .59.

This success with the drone R/C equipment led Babcock into the hobby industry. He had his engineers miniaturize and simplify the drone system to suit the needs of a model. To facilitate this, Babcock Radio Controls (a hobby division) was established, and it operated from the building that housed the Electronic Corporation. The growth of this division led to a need for larger quarters, and it was eventually moved to Laguna Beach. Along the way, several model-oriented engineers were involved (Bob and Dick Eck, John Sweers and Dick Schumacher as a consultant).

FROM DRONES TO MODELS

Babcock's first miniaturized drone equipment for modelers was a single-channel tone receiver—the BCR-3—and its companion transmitter—the BCT-2. Of course, you needed actuators to complete the system, and soon, Babcock offered a complete line of well-made, reliable escapements (more than 150,000 of these were sold).

At that time, the Babcock system probably came closer than anything else to matching the simplicity and reliability of today's equipment. Its only shortcoming was its weight; the robust receiver and the complement of batteries required were much heavier than was usual, but they *seldom failed!*

The most important Babcock effort came just before the arrival of the reed era. The company astounded the R/C world by offering a 3-channel multi-control system. (This was a giant step from single channel and the Mickey Mouse multi systems then in use.) It had the necessary transmitter that operated an audio-discriminating receiver. The three transmitter controls produced separate audio frequencies. In the receiver, each tone was filtered to a specific actuator outlet, so three separate controls were possible. Escapements were used as actuators, so operating the system was like flying three single-channel systems simultaneously! Back then, this was no big deal, as we only expected to operate one control at a time, but if escapements were used, a pulse sequence would be required for *each* control. Unlike today (or

(Continued on page 36)

GOLDEN AGE

even with reeds), you couldn't just move the stick to the desired control position!

A SIGNIFICANT SERVO

For this part of the story, I'm relying on memory, so please write to correct me if I'm wrong. I remember a Babcock servo that someone affectionately called the "mailbox" because its housing resembled one. Two of the servo's three channels were used to operate it and the elevators. The third channel operated a compound escapement for the rudder and another escapement for engine control. Complicated, you say?—of course; but remember that these were the early days of multi-controls, and *anything* was better than nothing!

At this point, Babcock must have seen some advantages in the 465MHz band (perhaps Citizen-Ship's success with its 465 had inspired him.), because he devoted much effort to the development and production of an exceptionally well-done 465 system. Unfortunately, sales were poor, and it was seldom seen at flying fields.

Babcock R/C was nevertheless successful, and the operation was greatly expanded. Several well-known R/C modelers (including Chuck Hollinger, Doug Spreng and Keith Storey) joined the staff, and they started to produce model kits. First came a Schumacher-designed "Breezy" (which was well accepted), and then a "Breezy Senior" for multi controls, and after that, a Goodyear Racer midwing designed by Hollinger.

Other manufacturers just

AN UNSUNG HERO

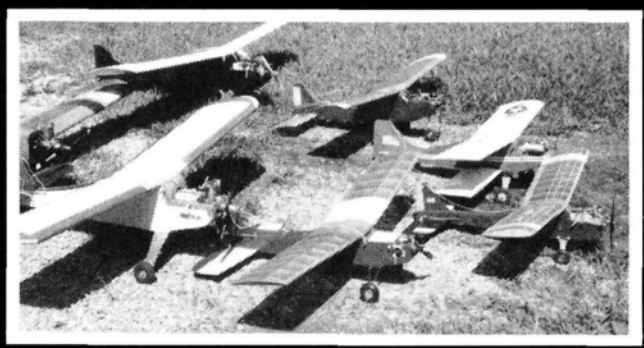
It's easy to write about the "big names" in R/C—how they performed and what they did to promote R/C and modeling. "Local experts," who enjoy the hobby all their lives and are indispensable to fliers like you and me, are more often overlooked. Most accomplished R/Cers owe a lot to a friendly flier who always helped when they needed it most. These people run the clubs, teach modeling and flying, promote activities and increase the popularity of R/C; I'm sure you know the type of person I'm talking about.

A recent letter from Tom Dixon of Marietta, GA, brought the sad news of the death of Lewis Chambers of Macon, GA. Many modelers in the Southeast benefitted in one way or another from knowing Lewis. His contributions to the sport seem endless: constant modeling, promoting activities, helping everyone who came along and serving as AMA vice president.

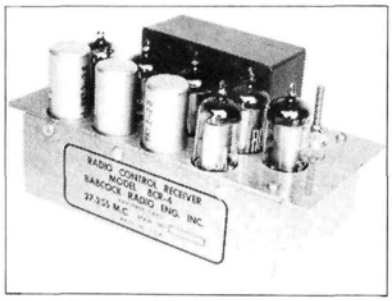
Lewis started modeling in early free-flight days, and with the introduction of C/L, his interest grew. He could now fly in his backyard! Radio control fulfilled his dreams; the sky was the only limit to what could be accomplished. So, from the very first days, he moved with the growth of R/C, from one challenge to the next.

At 75, Lewis was still going strong. He was one of the early promoters of vintage R/C, because he felt that youngsters should know their heritage, and he flew his large fleet of OT R/Cs for them. He also established a Vintage R/C Fly-In as part of the prestigious Cherry Blossom Festival of which Macon is so proud. Lewis had big plans for the '91 affair and was looking forward to promoting it. We expect that the Fly-In will go on in his honor.

Tom Dixon expresses our feelings well, saying we extend our sympathy to Louis's wife, Mary, and to his sons, Rich and David, who carry on his tradition.



At 75, Lewis Chambers of Macon, GA, was still flying his fleet of old-timers, which he kept for demonstrations and fun!



The reliable Babcock 3-channel receiver. The black box on top contained the three audio filters; the metal cylinders were hermetically sealed relays; the glass "jugs" were tubes. It took six to get three channels!

watched what modelers were doing and did their best to meet their needs, but Babcock was an innovator. Perhaps he was impressed by the way in which Cox had introduced C/L to the public (RTF plastic C/L planes) and thought that the same could be done with R/C.

Babcock's market analysis indicated that price ruled out anything beyond single-channel radios. This led to the production of a neat, light, single-channel carrier wave system: the receiver was called the "Magic Carpet" and the transmitter, the "Magic Wand." Unfortunately for R/C, this Babcock offering was introduced just as the popularity of single channel was waning (especially C/W types, which were superceded by the audio coding systems that were more able to reject interference), and multi was exploding onto the scene.

Chuck Hollinger designed a couple of slick, reasonably successful, R/C plastic boats, and he followed these with a few plastic-airplane designs. I don't remember what became of them, but the entire program wasn't very successful.

So what happened to Babcock Radio Control Corp.? It was moved and reorganized several times. Eventually, key personnel left to set up their own small operations, and they might have drawn on their Babcock experiences to produce some worthwhile R/C equipment that never saw widespread use. ■

BASICS OF RADIO CONTROL

by RANDY RANDOLPH

Field etiquette for beginners

ALL SPORTS HAVE rules of conduct that are understood and followed by those who participate in them, and R/C airplane flying is no exception. Some rules *must* be followed to create safe flying conditions, and others are simply good manners. To avoid embarrassment, new enthusiasts should know these rules before they make their first flight. Only a few are "critical," so I'll discuss them first.

CRITICAL COMMANDMENTS

Never turn on your transmitter until the frequency is clear and won't interfere with other aircraft in flight. Every flying field has some type of frequency control system (i.e., flags, pins, membership cards, etc.). Whether you're flying for the first time, or it's your first time at a new field, you *must* learn the field's control system before you turn on your equipment. "Shooting down" another pilot's aircraft because of careless transmitter operation is unforgivable and very expensive! Although this rule is primary and irrevocable, it isn't part of the safety code that must be followed to qualify for insurance as a member of the Academy of Model Aeronautics (AMA). That's unbelievable!

To show respect for other modeleres and spectators, test your engine away from the pit area, but get the frequency first!

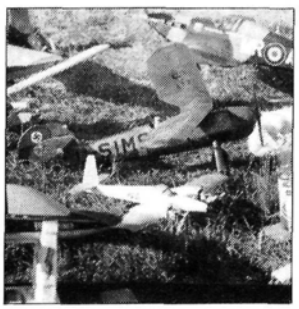
Never fly an airplane over spectators, fellow pilots, or the pit area. Although this rule *is* part of the AMA code, it's violated almost daily at flying fields across the nation. Some pilots like to show off their flying skills by flying in an unsafe manner. Resist the temptation to "flaunt" your new skills!

Ground-check your radio equipment immediately after you install it or make any repairs to the plane. You don't want to destroy your model on its first flight just because the radio equipment doesn't work properly. To ground-check your equipment, remove the transmitter antenna, turn on the transmitter and the receiver and walk away from the aircraft, checking to make sure that the control-surface movements correspond with the stick movements. They should work properly from at least 50 feet away, though 100 feet away is preferable.

AIRPLANE ETIQUETTE

Some rules should be observed out of courtesy. Although violating them isn't a "capital" offense, following them shows good manners. Here are some examples:

Engine Noise. Even engines with good mufflers are loud. Some fields have rules that forbid you to run engines in the pit area because they make too much noise. Even if the rules don't forbid it, you can easily move downwind of the pits before you conduct an engine test. It will be appreciated by your fellow modelers.



Wouldn't it be a shame to blow dirt and dust onto these airplanes? Look around before you start your engine!

Proper Engine Starts. Starting engines in the pits before a flight is a common practice, and if it's done properly, it's an accepted procedure at most fields. Before you start your engine, make sure there aren't any people or planes nearby. The blast from a prop can send dirt and dust a long way—especially downwind. It's difficult to make friends if you blow dirt and dust on them and their planes, field boxes, engines, or radios. Immediately after you start the engine, pull the throttle back to idle, and if you need to make any needle adjustments, wait until you're well away from the pit area.

Don't be a frequency hog. Prepare your aircraft for flight while you're waiting for your frequency, rather than after you've received the pin. When you have the frequency, start the engine, check the control response and make your flight. When you've finished, turn off the transmitter and relinquish the channel to the next flier. This sounds so simple, yet people often forget to release their frequency when they've finished flying.

Flying R/C airplanes is enjoyable, and part of the enjoyment is respecting your fellow modelers and yourself. If you treat everyone as you want to be treated, you'll have more friends at the field. ■

Fighting Aircraft

by GERRY YARRISH

IT'S IMPOSSIBLE for the world to ignore the invasion of Kuwait. In the ensuing conflict, acquiring and maintaining air supremacy with the specialized and formidable aircraft of the U.S. and allied Air Forces have

F-117A STEALTH FIGHTER

MISSION: to exploit low, observable, stealth technology. This single-seat tactical fighter/attack design can penetrate high-risk areas and attack valuable targets with pinpoint accuracy. (U.S.A.F.)

SPECS: *length:* 65 ft., 11 in.; *wingspan:* 43 ft., 4 in.; *height:* 12 ft., 5 in.; *weight:* 52,500 lbs. (max. gross takeoff); *propulsion:* two GE F-404 jet engines; *max. speed:* high subsonic; *armament:* internal weapons carriage; *crew:* one.

F/A-18 HORNET

MISSION: a strike-fighter designed to perform both fighter and attack roles for the U.S. Navy and the U.S. Marine Corps.

SPECS: *length:* 56 ft.; *wingspan:* 37 ft., 5 in.; *height:* 15 ft., 3 in.; *weight:* 36,628 lbs. (fighter—max. gross takeoff), 51,900 lbs. (attack—max. gross takeoff); *max. speed:* Mach 1.7+; *propulsion:* two F404-GE-400 low-bypass turbofan engines; *armament:* one 20mm Mk-61A1 Vulcan cannon; Sparrow III and Sidewinder missiles (fighter mission); guided and conventional air-to-ground ordnance and FLIR/LDT pods (attack mission); *crew:* one.

AV-8B HARRIER

MISSION: to provide light-attack and close air support for ground forces. (U.S. Navy/Marines)

SPECS: *length:* 46 ft., 4 in.; *wingspan:* 30 ft., 4 in.; *height:* 11 ft., 9 in.; *weight:* 12,500 lbs. (empty), 29,750 lbs. (max. gross takeoff); *max. speed:* 547 knots; *propulsion:* one Pegasus F402-RR-406 engine; *armament:* one 25mm gun system, guided and conventional air-to-ground ordnance and Sidewinder missiles; *crew:* one

A-7E CORSAIR II

MISSION: to destroy fixed and moving targets on land and at sea and to provide interdiction and close air support. (U.S. Navy/Marines)

SPECS: *length:* 46 ft.; *wingspan:* 39 ft.; *height:* 16 ft.; *weight:* 19,111 lbs. (empty), 42,000 lbs. (max. gross takeoff); *max. speed:* 600 knots; *propulsion:* one Allison TF-41-A-402D non-afterburning turbofan; *armament:* one 20mm Mk61A1 Vulcan cannon, two Sidewinder air-to-air missiles and various combinations of bombs and/or missiles; *crew:* one.

A-6E INTRUDER

MISSION: to destroy both fixed and moving targets at sea or on land, in all weather conditions, day and night. (U.S. Navy)

SPECS: *length:* 54 ft., 8 in.; *wingspan:* 53 ft.; *height:* 15 ft., 6 in.; *weight:* 28,000 lbs. (empty), 60,400 lbs. (max. gross takeoff); *max. speed:* 563 knots; *propulsion:* two Pratt & Whitney J52-P8B engines; *armament:* bombs, rockets and air-to-surface missiles; *crew:* two.

EA-6B PROWLER

MISSION: to provide an umbrella of protection for strike aircraft and fleet battle group by denying or delaying enemy radar, data links and communications. (U.S. Navy)

SPECS: *length:* 59 ft., 10 in.; *wingspan:* 53 ft.; *height:* 16 ft., 3 in.; *weight:* 34,000 lbs. (empty), 61,500 lbs. (max. gross takeoff—ground), 58,600 lbs. (max. gross takeoff—carrier); *max. speed:* 541 knots; *propulsion:* two Pratt & Whitney J52-P408 engines; *armament:* AGM-88A HARM; *crew:* four.

S-3 VIKING

MISSION: to seek and destroy enemy submarines and provide surveillance of surface shipping. (U.S. Navy)

SPECS: *length:* 53 ft., 4 in.; *wingspan:* 68 ft., 8 in.; *height:* 22 ft., 9 in.; *weight:* 26,864 lbs. (empty), 52,539 lbs. (max. gross takeoff); *max. speed:* 450 knots; *propulsion:* two General Electric TF-34-GE-400B turbofan engines; *armament:* four Mk-46 torpedoes, two Harpoon torpedoes (S-3Bs), bombs and mines; *crew:* four.

# of Desert Storm

Tools of the trade

been vital to the Allies' strategy. In recognition of the important role they've played, Model Airplane News presents this summary of the primary fighter aircraft that have been involved.

E-2C HAWKEYE

MISSION: to provide all-weather, airborne, early warning and command-and-control functions for a carrier battle group. Additional missions include: surface-surveillance coordination, strike-and-intercept control, search-and-rescue guidance and communications relay. (U.S. Navy)

SPECS: *length:* 57 ft., 6 in.; *wingspan:* 80 ft., 7 in.; *height:* 18 ft., 3 in.; *weight:* 53,000 lbs. (max. gross takeoff); *max. speed:* 320 knots; *propulsion:* two Allison T-56-A427 turboprop engines; *crew:* five.

F-15A EAGLE

MISSION: a single-seat, high-performance, air-superiority fighter that incorporates state-of-the-art IFF (Identification Friend or Foe), look-down radar and HUD (Head-Up-Display control-panel data) systems. (U.S.A.F.)

SPECS: *length:* 63 ft., 9 in.; *wingspan:* 42 ft., 9 in.; *height:* 18 ft., 5 in.; *weight:* 27,300 lbs. (empty), 68,000 lbs. (max. gross takeoff); *propulsion:* two Pratt & Whitney F100-PW-100 turbofan engines; *max. speed:* Mach 2.5; *armament:* one 20mm cannon, four Sparrow missiles, four Sidewinder missiles and up to 16,000 pounds of external ordnance; *crew:* one.

F-14A TOMCAT

MISSION: an air-superiority fighter designed to attack and destroy multiple airborne targets in all weather conditions, day or night. (U.S. Navy)

SPECS: *length:* 62 ft., 9 in.; *wingspan:* 64.1 ft. (unswept), 38 ft. (swept); *height:* 16 ft.; *weight:* 41,500 lbs. (empty), 69,800 lbs. (max. gross takeoff); *max. speed:* Mach 2+; *propulsion:* two Pratt & Whitney TF30-P-414A turbofan engines with afterburners; *armament:* six Phoenix AIM-54A missiles, four Sparrow missiles, four Sidewinder missiles and one 20mm Mk-61A1 Vulcan cannon; *crew:* two.

SH-60F CV HELO

MISSION: to engage in anti-submarine warfare using Dipping sonar and Sonobuoy launching. Its subsystems include: rescue hoist, automatic approach with coupled hover and automatic departure. (U.S. Navy)

SPECS: *length:* 64 ft., 10 in.; *rotor diameter:* 53 ft., 8 in.; *height:* 17 ft.; *weight:* 21,800 lbs. (max. gross takeoff); *propulsion:* not available; *max. speed:* 133 knots; *armament:* two Mk50 torpedoes; *crew:* four.

F-4 PHANTOM II

MISSION: because it's the workhorse of many air forces, the operational life of this tactical fighter/bomber is far from over. Adapted for low-level attack roles, further electronic updates have improved its ability to wage war and win. (All branches)

SPECS: *length:* 58.26 ft.; *wingspan:* 38.38 ft.; *height:* 16.27 ft.; *weight:* 26,450 lbs. (empty), 58,000 lbs. (max. gross takeoff); *propulsion:* two GE J79-GE-15 jet engines; *max. speed:* Mach 2.2 at sea level; *armament:* four AIM-7E Sparrow IIIB air-to-air missiles, 4 NWC AIM-9B Sidewinder IA missiles or 6 AIM-7E air-to-air missiles and 16,000 pounds of external stores (ground attack); *crew:* two.

F-111E

MISSION: this medium-range strategic bomber's variable-sweep wings allow its pilot to exploit both slow- and fast-flight extremes. The pressurized cockpit module maximizes the crew's safety in the event of an emergency escape. (U.S.A.F.)

SPECS: *length:* 73 ft., 6 in.; *wingspan:* 70 ft. (extended), 33 ft., 11 in. (swept); *height:* 17 ft., 1 in.; *weight:* 100,000 lbs. (max. gross takeoff); *propulsion:* two Pratt & Whitney TF30-P-7 turbofans with afterburners; *max. speed:* Mach 2.5 at 36,000 ft.; *armament:* four AGM-69A SCRAM air-to-surface missiles and up to six nuclear bombs or 31,500 pounds of conventional bombs; *crew:* two.

A-10A THUNDERBOLT II

MISSION: to provide clear-weather, tactical, close ground support. Originally designed as a tank killer, it's heavily armored to give its pilot maximum protection. (U.S.A.F.)

SPECS: *length:* 53.31 ft.; *wingspan:* 57.48 ft.; *height:* 14.66 ft.; *weight:* 20,229 lbs. (empty), 44,545 lbs. (max. gross takeoff); *propulsion:* two GE TF34-GE-100 turbofans; *max. speed:* 517mph; *armament:* one GE GAU-8/A Avenger 7-barrel 30mm gun with 1,350 rounds and 11 hard points for 16,600 pounds of external loads; *crew:* one

B-52 STRATOFORTRESS

MISSION: provides strategic high-altitude heavy saturation (carpet) bombing to destroy enemy installations. (U.S.A.F.)

SPECS: *length:* 156.5 ft.; *wingspan:* 185 ft.; *height:* 48 ft., 3 in.; *weight:* 450,000 lbs. (max. gross takeoff); *propulsion:* eight Pratt & Whitney J57-P-29W turbojet engines; *max. speed:* 650mph at 20,000 ft.; *armament:* 60,000 pounds of mixed conventional bombs and, in the tail, four 50 ca. machine guns or one 20mm Gatling gun; *crew:* six.

JAGUAR E

MISSION: this two-seat advanced, operational conversion trainer has secondary tactical strike and ground-attack capabilities. (R.A.F./France)

SPECS: *length:* 57 ft., 6 in.; *wingspan:* 28 ft., 6 in.; *height:* 16 ft.; *weight:* 34,612 lbs. (max. gross takeoff); *propulsion:* two Rolls-Royce/Turboméca Adour MK 102 turbofan engines; *max. speed:* Mach 1.6; *armament:* two 30mm DEFA cannons and five external hard points for up to 10,000 pounds of mixed conventional ordnance; *crew:* two.

C-130 HERCULES

MISSION: the C-130 is a multipurpose transport plane with air-drop capabilities. The MC-130 has Combat Talon equipment that uses cables to recover personnel or gear in low-level ground passes. The AC-130 Spectre gun ship is a ground-attack aircraft, and it's one of the Air Force's most heavily armed.

SPECS: *length:* 97 ft., 9 in.; *wingspan:* 132 ft., 7 in.; *height:* 31.1 ft.; *weight:* 175,000 lbs. (max. gross takeoff); *propulsion:* four 4,508hp T56-A-15 turboprop engines; *max. speed:* 386mph; *armament:* (AC-130) various mounted guns, including 20mm, 30mm and 40mm cannons or two 20mm, 6-barrel, Vulcan cannons; *crew:* 10 to 13.

PANAVIA TORNADO

MISSION: an air-to-air and air-to-ground fighter that specializes in low-altitude attacks. At an altitude of less than 100 feet, it's computer guided and uses bomblet cratering to take out enemy airfields. (R.A.F.)

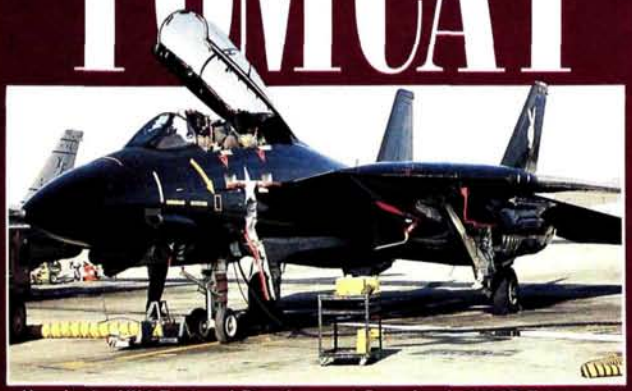
SPECS: *length:* 54 ft., 10 in.; *wingspan:* 45 ft., 7 in.; *height:* 19 ft., 6 in.; *weight:* 31,065 lbs. (empty), 60,000 lbs. (max. gross takeoff); *propulsion:* two Turbo-Union turbofan engines; *max. speed:* 691mph; *armament:* 19,840 pounds of JP 233 airfield attack weapons; *crew:* two.

F-16 FIGHTING FALCON

MISSION: a compact, multipurpose fighter/attack aircraft with a maneuverability and combat radius that exceed all current Warsaw Pact fighter aircraft. (U.S.A.F.)

SPECS: *length:* 49 ft., 5 in.; *wingspan:* 32 ft., 8 in.; *height:* 16 ft.; *weight:* 35,400 lbs. (max. gross takeoff); *propulsion:* one Pratt & Whitney F100-PW-100 turbofan with afterburner; *max. speed:* Mach 2+; *armament:* one Mk-61A1 20mm cannon with 500 rounds, six AIM-9 IF missiles and electronic countermeasure pods; *crew:* one.

THE LATEST TOMCAT



Here's the VX4 Test and Development Squadron's F-14D Tomcat. A black airframe with a Playboy Bunny logo on the vertical fin is this squadron's traditional paint scheme.

The latest Tomcat variant that has been used in the Persian Gulf is the F-14D. Its General Electric engines produce 20 percent more thrust than the Pratt & Whitney engines used in the previous version. In addition, the F-14D's new, digital-avionics system makes it one of the world's deadliest airplanes.

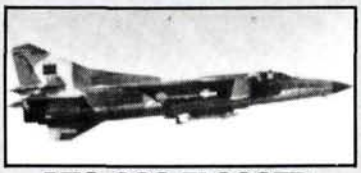
by Rob Wood

IRAQI AIR STRENGTH

Iraq entered the Gulf War with approximately 650 operational jet aircraft. Although this was a formidable fleet when compared with the size of other Arab air forces, the Pentagon estimated that only 65 or 75 of these aircraft were state-of-the-art Soviet models. Poor training and substandard maintenance further limited the effectiveness of Iraqi pilots and aircraft. Faced with possible "mano a mano" confrontations with the coalition forces' vastly superior air power, Iraqi pilots wisely kept their heads down during the first days of the war.

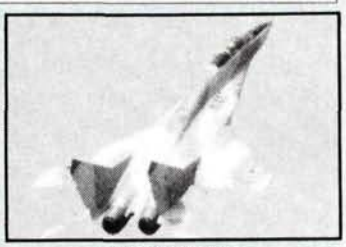
The four types of aircraft shown here were among those shot down.

by RON WOOD



MIG-23S FLOGGER

Mfg: Soviet Union; type: multipurpose fighter; year: 1970; max. speed: 1,319mph at 36,000 ft.; range: 620 miles; armament: two 23mm cannons and four air-to-air missiles. (A majority of the planes that have been shot down are Floggers.)



MIG-29UB

Mfg: Soviet Union; type: multipurpose fighter; year: 1983; max. speed: Mach 2+ at 36,000 ft.; range: not available; armament: one 20mm cannon, two AA-10 Alamo radar-guided missiles and two AA-8 Aphid infrared missiles. (These planes are the latest Iraqi operational fighters.)

)TO CREDITS:

'tesy of Scale Model Research
IB Harrier
' Stratofortress
Phantom II
Fighting Falcon
1E Fighter Bomber
7A Stealth Fighter
ıvia Tornado
' Skyhawk
0 Hercules

ich Uravitch
' Thunderbolt II

'tesy of the U.S. Air Force
A Eagle

'tesy of the U.S. Navy
' Intruder
' Hawkeye
A Tomcat
' Corsair II
B Prowler
18A Hornet
Viking

'tesy of United Technologies/
rsky Aircraft
3H Sea King Helicopter
60F CV Helo

'tesy of McDonnell Douglas
copter Co.
64 Apache.

ı "Superprofile," courtesy of
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O Publishing, Inc.
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ault Mirage F.1C

'tesy of Aviation Week &
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Test and Development
adron F-14D Tomcat

A-4E SKYHAWK

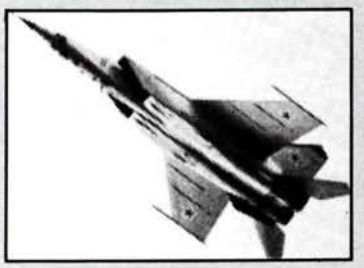
MISSION: an attack aircraft with provisions for many different types of support roles. It was specifically designed for naval aircraft-carrier operations. (Designed for the U.S. Navy; used by the Kuwaiti Air Force.)

SPECS: *length:* 40 ft., 1 in.; *wingspan:* 27 ft., 6 in.; *height:* 15 ft., 2 in.; *weight:* 24,000 lbs. (gross); *propulsion:* one Pratt & Whitney J52-P-6 turbojet engine; *max. speed:* 685mph; *armament:* two 20mm cannons and 8,200 pounds of externally mounted ordnance; *crew:* one.

SH-3H SEA KING

MISSION: a helicopter designed to detect, classify, track and destroy enemy submarines. It can also provide logistical and search-and-rescue support when deployed from an aircraft carrier. (U.S. Navy)

SPECS: *fuselage length:* 54 ft., 9 in.; *length:* 73 ft.; *rotor diameter:* not available; *height:* 17 ft.; *weight:* 11,865 lbs. (empty), 21,000 lbs. (max. gross takeoff); *max. speed:* 166mph; *propulsion:* two General Electric T58-GE-10 turboshaft engines; *crew:* four (including two sonar operators).



MIG-25S FOXBAT

Mfg: Soviet Union; type: multipurpose fighter; year: 1967; max. speed: 2,100mph at 62,995 ft.; range: 702 miles; armament: two X 23mm cannons and four air-to-air missiles. (Foxbats are similar to the F-15A Eagle.)

DASSAULT MIRAGE F.1C

Mfg: France; type: fighter/bomber; year: 1973; max. speed: 1,450mph at 40,000 ft.; range: 560 miles; armament: two 30mm cannons and 8,800 pounds of bombs or Exocet missiles.

AH-64 APACHE

MISSION: this multi-mission attack helicopter is designed to fight and survive a full-scale war as well as short-term special operations, i.e., armed reconnaissance, anti-armor, or drug interdiction. (U.S. Army)

SPECS: *length:* 58.2 ft.; *rotor diameter:* 48 ft.; *wingspan:* 17.2 ft.; *height:* 15.3 ft.; *weight:* 11,150 lbs. (empty), 21,100 lbs. (max. gross takeoff); *propulsion:* two T700-GE-701C turboshaft engines; *max. speed:* 158 knots; *armament:* 16 Hellfire missiles, 76 70mm aerial rockets, 1,200 rounds of 30mm ammunition and four Stinger air-to-air missiles; *crew:* two.

PHOTOS BY CHRIS TRUE

YOSHIOKA

on air

THE ON AIR 1700E is an ARF electric glider manufactured by the Yoshioka Model Company. The kit comes with a typical RS550-size Mabuchi motor (M2500BB), an excellent prop adapter/spinner and a Yoshioka 7x4.5 prop. This is one of the best ARFs I've seen; it has excellent parts fit and several innovative design features. It was chosen the power model glider of the year at the 1989 Nuremberg Show.*

A new, high-performance, low-drag electric sailplane

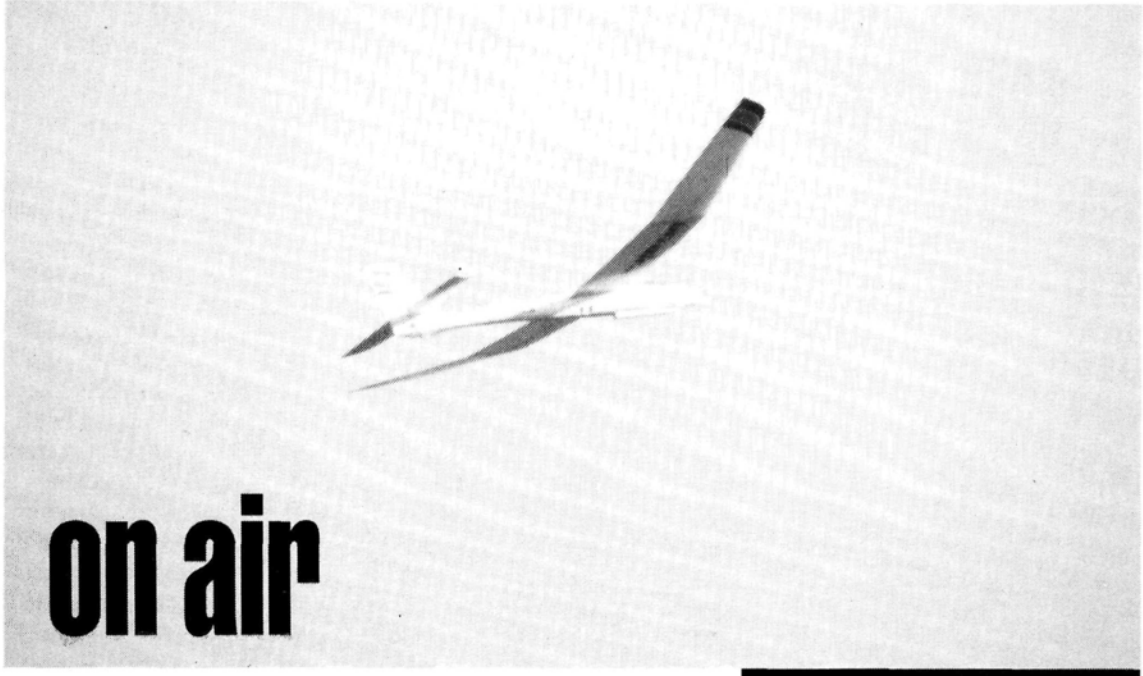
by CHRIS TRUE

THE KIT

When I opened the box, I was faced with a sea of poly bags! The large pieces (e.g., the wing panels and fuselage) were padded with bubble sheets; smaller items (e.g., the motor, prop, cowl and hardware) were in a separate box so they wouldn't dent the foam parts.

The way in which the wings are constructed is one of the kit's innovative features. (The wing comes in two pieces, and there's a wire joiner that passes through the fuselage.) If you hold the wing panel up to a strong light, you'll see that it's partially hollow.

The inside is of dense foam, which curves upward from the root end of the trailing edge to approxi-



on air

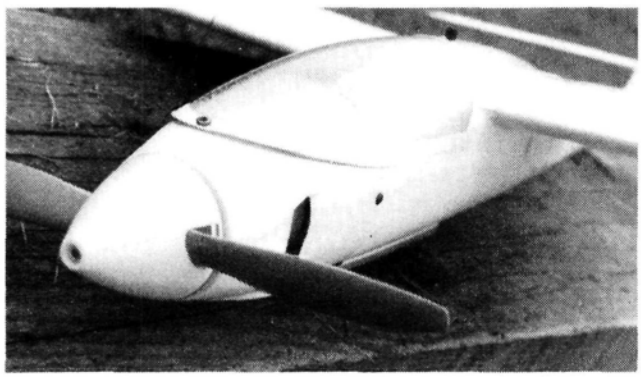
mately the CG point of the airfoil, and then backward to the trailing edge at the polyhedral break. It does the same thing from the poly break to the tip.

The entire wing is covered with a hard plastic that hides the blemishes and gives it a stressed-skin type of surface. The wing joiner slides into brass tubes that are mounted in hardwood blocks to spread the load, and a spring holds the panels tightly against the fuselage.

CONSTRUCTION

For an ARF, the On Air's instructions are very good, but they were obviously translated from Japanese. The information is all there, but the text could be more readable.

I started the assembly at 5 p.m. and had finished by 1 a.m.—even with time out for dinner and taking construction photos. Depending on your skill level, expect to spend between 5 and 15 hours. Everything fits precisely, so if you have trouble, you're probably doing something wrong.



A NACA-style scoop cools the motor. A Yoshioka 7x4.5 prop is shown.

After marking the crisply die-cut ply parts with their numbers, I began construction in earnest. First, in the fuselage, I cut air exit holes and clearance holes for the spring that holds the wing panels against the fuselage sides. This step requires a steady hand with an X-Acto knife.

Thread the screw eyes into the dimples in the wing root and then remove them. Put a dab of 5-minute epoxy into the holes before screwing the eyes back in. To fit the retention spring, the screw eyes must protrude into the fuselage slightly. That's it for the wing construction. It took me approximately 30 minutes to apply all the stickers. To avoid making wrinkles, don't put graphics too close to the wing tips (leave approximately 1/2 inch).

The next task is critical, so take your time! Make cuts on the tail and fuselage by following the lines printed on the parts. Remember: it's better to make a few shallow cuts than one deep one. Then make very shallow cuts on the stab, and peel off the plastic to give the epoxy something to stick to.

Slide the wing joiner rod and the locator rod into the fuselage, and put the wing panels into place so that you'll have something with which to align the tail. In my case, the tail sat level on the first try and needed no adjustment. Because I had mixed the 5-minute epoxy, I attached the rudder at this time. Pin-type hinges and pre-cut pockets are provided.

The cowl mount is built up of several die-cut parts that must be joined with CA and epoxied into the front of the fuselage. Epoxy the servo mount into the rear of the radio/battery compartment.

The rear of the wing center-section cover is bolted to two tiny pieces of ply (F-7), which are epoxied into a small trough that you dig in the foam. I'm still looking for a better hold-down arrangement, because I know that little 2x6mm screw will get lost or eventually strip out.

I used an X-Acto, scissors and a drill to bring the blow-molded cowl to its final shape. This was the most difficult cut in the whole kit because the thickness of the cowl molding varies from 1/64 to as much as 3/16 inch. It's made of pliable polypropylene, which is much easier to work than the hard plastic in some kits, but it was still a trial. I mounted the motor on the cowl and then

SPECIFICATIONS

Type: *Electric-powered sailplane*
Wingspan: *63.3 inches*
Wing Area: *480 square inches*
Wing Loading: *13.8 ounces per square foot*
Weight: *45 to 47 ounces*
Length: *40.9 inches*
Power Req'd: *05 motor (M2500 BB); six or seven cells*
No. of Channels: *3 (elevator, rudder, motor) with a Yoshioka 7x4.5 prop*
Sug. Retail Price: *$199.99*
Features: *The On Air ARF has a low-drag planform; a two-piece wing with well-engineered joining system; very light, stressed-skin wing construction (expanded-bead foam covered with hard plastic); pre-routed pushrod and antenna tube; accurately machined prop-holder/spinner assembly with plastic nose cone and metal backplate.*
Comments: *The On Air conserves energy well: a 20-foot altitude loss results in a quick gain in airspeed, which can be used for wind penetration or easily converted back to altitude. This plane is best for those with some flying experience; beginners will have difficulty with landings because of its great speed.*

skipped ahead.

The prop assembly consists of a precisely machined prop holder and metal backplate, a plastic nose cone and a nylon prop. It runs perfectly true and is just another example of the high quality that's evident throughout this kit. Next, I soldered the motor leads and Sermos* connectors, and I attached the motor/cowl assembly to the fuselage with four 2x6mm screws.

It was easy enough to score and break out the cockpit floor and then to nibble away at the canopy with scissors until I reached the line. (The canopy is brittle, so cut a little at a time.) It wasn't clear from the instructions whether the cockpit floor and canopy should be glued into the fuselage.

I didn't want to glue down the assembly, because my motor control was in the front of the fuselage, so I attached the canopy to the cockpit floor with MicroWeld*, which is a solvent-type plastic cement. I then screwed down the front of the assembly and stuck a piece of white plastic tape onto each side of the canopy's rear to secure it to the fuselage. The canopy must be secure because it holds down the front of the wing center section and, according to the instructions, the aircraft might crash if it comes off!

RADIO

The On Air requires microservos; I chose Futaba* S-33s, and they fit perfectly. Most electrics (and 05s in particular) are "weight sensitive," so even if there's room for standard-size servos, use micros. You can see the performance difference a few extra ounces make.

For motor control, I chose a Graupner* speed switch 25. It has electronic on/off and BEC, which avoids the extra weight of a receiver pack. After installing the control horns, I was ready to hook-up the pushrods. I had quite a shock: Yoshioka instructs you to attach the rod ends and clevises to the pushrod material with CA!

Because the rods come already installed and are of an odd metric size, I couldn't see any way to modify them to a more conventional configuration. I used the CA and then yanked and tried to break the joints, but they held. Set the rudder throw to 18mm each way and the elevator throw to 10mm each way, check the balance (my plane was slightly nose-heavy), and the ship is ready to fly.

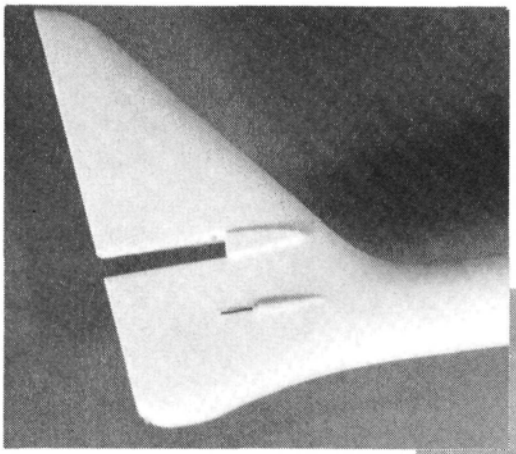
FLYING

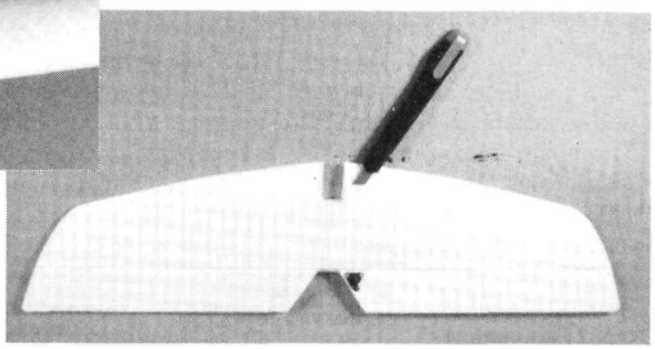
I was really looking forward to flying the On Air 1700E. I charged my 1200mAh SCR Kyosho* pack on my Aristo-Craft* peak-charger and headed to the local field.

I spent the first flight checking the On Air's handling characteristics. After a hand-launch, the plane required six or seven clicks of up-trim before it achieved a steady climb, but it tracked straight. Its handling is typical of a polyhedral glider with a semisymmetrical, Eppler-type airfoil. The plane is very

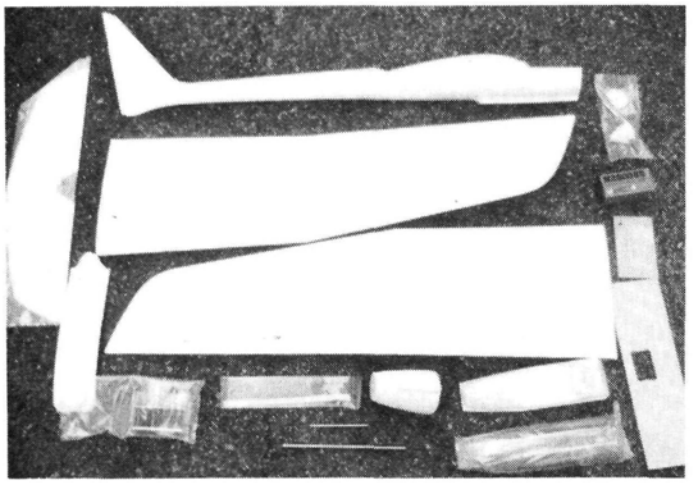
One of the best predictors of an electric plane performance is its power-to-weight rati which is expressed in watts per pound.

My On Air weighs 42 ounces, or 2.62 pounds (slight less than the manufacturer's specified weight). T measure the wattage, hook an ammeter to one wi between the battery and motor, and run the power sy tem up to full throttle. The On Air motor drew 18 amp on a 6-cell pack, so its power is 18x6 or 108 watt





■ *Above: This close-up of the vertical stab shows the critical cut.*
■ *Right: You have to cut a slot in the stab assembly and remove the surface skin.*



The kit parts without the poly bags that contain the wings and fuselage.

stable and will fly itself if you put in a few clicks of rudder trim for a gentle left circle.

After making a few low, slow passes for the camera, I decided to try an approach. I flew a normal left-hand landing pattern, and the On Air came down on final as if locked on rails. There was only one problem: it was 4 feet off the ground!

I tried again. This time, I flew a wider pattern and crossed the threshold only 3 feet off the ground. A slight touch of down-elevator reduced the plane's altitude, but when you think you'll never make it back to the field, turn onto final.

it doubled its speed. Because the On Air is so aerodynamically clean, it picks up speed in a hurry and can cover ground quickly if you hit some down air.

It took me a few more tries to master the proper technique for making slow landings. Basically, you fly the plane downwind past yourself at about 6 or 7 feet, and just scratched. What about duration? I managed to get in a flight of 15 minutes in dead air; I made three solid climbs of $1^1/2$ minutes each and spent the rest of the time gliding.

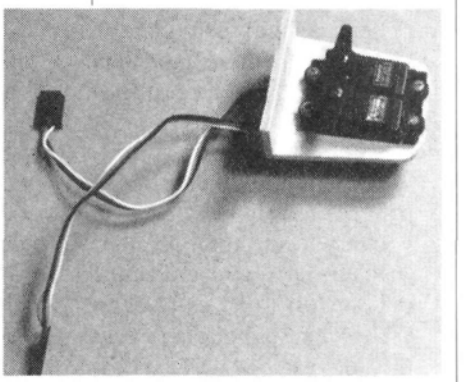
On the second flight, I flew the plane a little more aggressively. The On Air is capable of loops from level flight, rolls and stall turns from a slight dive, and even inverted flight and outside loops. Throughout these maneuvers, the airframe held up without a whimper, and with the built-in landing skid, the bottom of the fuselage wasn't even

CONCLUSION

The On Air has many great features, including a highly aerodynamic design, good parts fit, hollow detachable wing panels, excellent prop/holder/spinner assembly and detailed instructions. I do have a criticism: this plane should have a fuse and an arming switch for safety. (The manufacturer notes that JR speed controllers JRA220 and JRA240, which are recommended options for this plane, come with integral arming switches.) The instructions aren't clear in a few spots, but they're better than those of most ARFs.

If you're in the market for an electric ARF glider, I highly recommend this one. If you want a high-performance electric glider and don't want to scratch-build, I think this kit would work well with an AstroFlight* FAI 05. The On Air is very aerodynamic, although at 45 ounces, it's a little heavier than a built-up balsa plane.

**Here are the addresses of the companies mentioned in this article:*
Yoshioka/Hobby Dynamics Distributors, *P.O. Box 3726, Champaign, IL 61826.*
Sermos R/C Snap Connectors, *Cedar Corners Station, P.O. Box 16787, Stamford, CT 06905.*
MicroWeld, *Micro Scale Industry, 1555 Placentia Ave., Newport Beach, CA 92663.*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*
Graupner/Hobby Lobby International, *5614 Franklin Pike Cr., Brentwood, TN 37027.*
Kyosho/Great Planes Model Distributors, *P.O. Box 4021, Champaign, IL 61824.*
Aristo-Craft/Polk's, *346 Bergen Ave., Jersey City, NJ 07304.*
AstroFlight Inc., *13311 Beach Ave., Marina del Rey, CA 90292.* ■



■ *Left: The electronic on/off switch with BEC sits under the front ply plate in the radio compartment. The cover spring holds the wings tightly against the fuselage; and the receiver is mounted under the center-section cover.* ■ *Right: The servo assembly ready to be epoxied into the fuselage.*

PERFORMANCE HOP-UPS

When you divide this number by 2.6 pounds, you get a power-to-weight ratio of 41.22 watts/pound. The power required for comfortable sport performance is 40 to 60 watts/pound, so this glider should fly fairly well.

If you want more power from a given motor and battery combination, increase the load on the motor by switching to a bigger prop. Ferrite motors can handle up to 25 amps or so; most cobalts can handle 35 or 40.

I won an 8x4 Sonic-Tronics folding prop at a contest last summer. When I installed it on the On Air, the motor drew 23.5 amps. I performed some quick performance calculations: 23.5 amps x 6 volts = 141 watts. This number divided by 2.62 pounds equals 53.8 watts/pound—approximately a 25 percent increase in power.

Does the plane climb better?—you bet! It also glides better with the prop folded for less drag. A folding prop is a bolt-on modification; to install it, simply carve a bigger slot in the plastic spinner cone.

SMALL STEPS

MORE ON SMALL ENGINES

by RANDY RANDOLPH

The Magnum 10 is the latest high-performance .10ci engine. It's made on some of the most modern equipment in the industry—and it shows.

IF YOU haven't moved up to small airplanes yet, you'd better hurry, or you'll be a Johnny-come-lately. More and more modelers are finding smaller airplanes the ticket to more fun and games at less effort and expense. Those of us who fly small have a new airplane every few months rather than every few years. It must be awful to be stuck with the same old airplane year after year. See it like it is, if you haven't moved up to small airplanes, you're just getting older along with your airplane!

MAGNUM .10

The recent availability of really potent small engines in the .10 to .11 range has tracked the growth in this niche of the hobby. I've talked about the O.S., Super Tigre and Enya; now it's time for a word or two about the Magnum 10.

At the Chicago Hobby Show, the Magnum* people had a Magnum 10 case on display. Its inside was polished, and the sales talk was that the new machinery at the Magnum plant holds such close tolerances that the finished product looks like a mirror. Well, back home, I stripped mine down to see whether it was like the one on display; it was!—a very clean and well-made engine indeed.

On the bench, with 5-percent fuel, a Cox gray 7x3 prop and muffler, the Magnum 10 turned just a shade over 19,000rpm. That was after about a 30-minute break-in. There seemed to be no need to run it without the muffler when numbers like that jumped up. The throttle would allow an idle down around 3,200rpm with a smooth transition up and down.

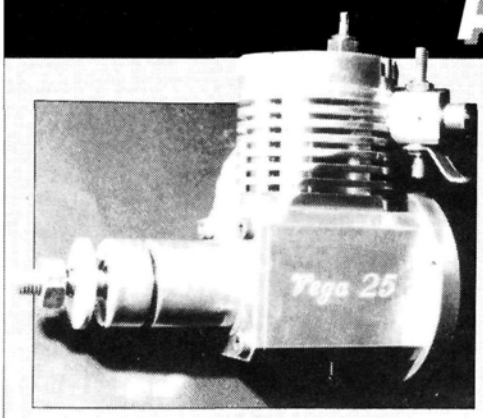
Someone said that what was really needed for small sport airplanes was an engine that would turn a big prop at around 8,500rpm. Although the Magnum 10 isn't designed to do anything like that, it will! With a 9x6 prop, it took an R/C short plug and two extra plug washers to get it down to 8,500, but down it *did* go. Not only that, but the throttle response was still very good, and it didn't seem to be overheating. As a bonus, it was quiet. This new breed of small engines shows better numbers than many of the .20s that are flying today.

WEBRA SPEED .10

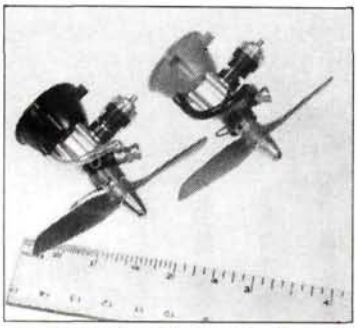
Last September, mention was made that the Webra* Speed .10 wasn't available in this country. Well, now it is. It's a rear-exhaust engine, and because there's a tuned pipe available as a factory option, it should be one more screamer in the "10 class." Next time, I'll have some numbers on this beauty.

For a number of years, Quarter Midget racing has been a "so-so" event. It has never been as popular as the Formula Is, for which it was

A NEW VEGA



Thanks to Dereck Woodward, SMALL's British connection, this is serial number 00001 of the new Vega 25 4-stroke engine being produced in England. According to Dereck, its performance seems to be better than that of the O.S. .20 and just a shade below the Surpass .26's. A radial mount like this is just about the best way to mount any engine, but it probably raises the ire of the people who manufacture engine mounts.



The old and the new. The black tank and case distinguish the new Cox .010 from the older model produced before 1980—different color, but the same power and beauty.

supposed to have been a less expensive alternative. It seems that a racing event designed around the .10- to .11-class engines, with simple rules (similar to the Quickee 500) would generate more interest than the scale-like Midgets. A clean airplane weighing about 2 pounds and having a wing area of approximately 350 square inches should move very well indeed with any of the .10s and still be fun to fly when it isn't screaming around the pylons.

Cox* still has a back-order situation with the new issue of TD .010's. They've been rather particular with inspecting and testing to ensure the performance of the new engine matches that of the older model. It's amazing that such a small package can deliver so much power. I'm not a Cox salesman, but it seems to me that every self-respecting modeler should have one of these engines.

**Here are the addresses of the companies mentioned in this article:*
Magnum engines; *distributed by Global Hobby Distributors, 10725 Ellis Ave., Fountain Valley, CA 92728.*
Webra engines; *distributed by Hobby Dynamics Distributors, P.O. Box 3726, Champaign, IL 61826.*
Cox Hobbies Inc., *1525 E. Earner Ave., Santa Ana, CA 92705.*

■

"Fireball" Hayes flies an F-86 by remote.

The monitor shows Ensign Nolo's view of the runway.

Paula Trisdale, operation conductor, monitors air traffic and coordinates the mission with local control towers.

Doomed Squad

by ROB WOOD

computer-generated map used to help
sign Nolo fly.

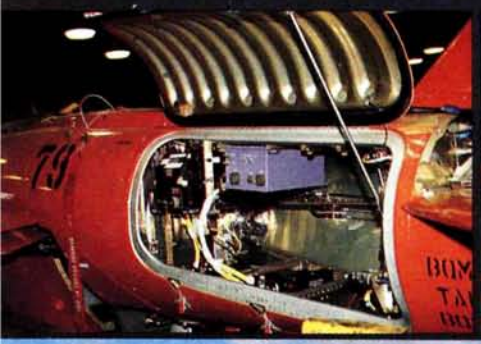
ron

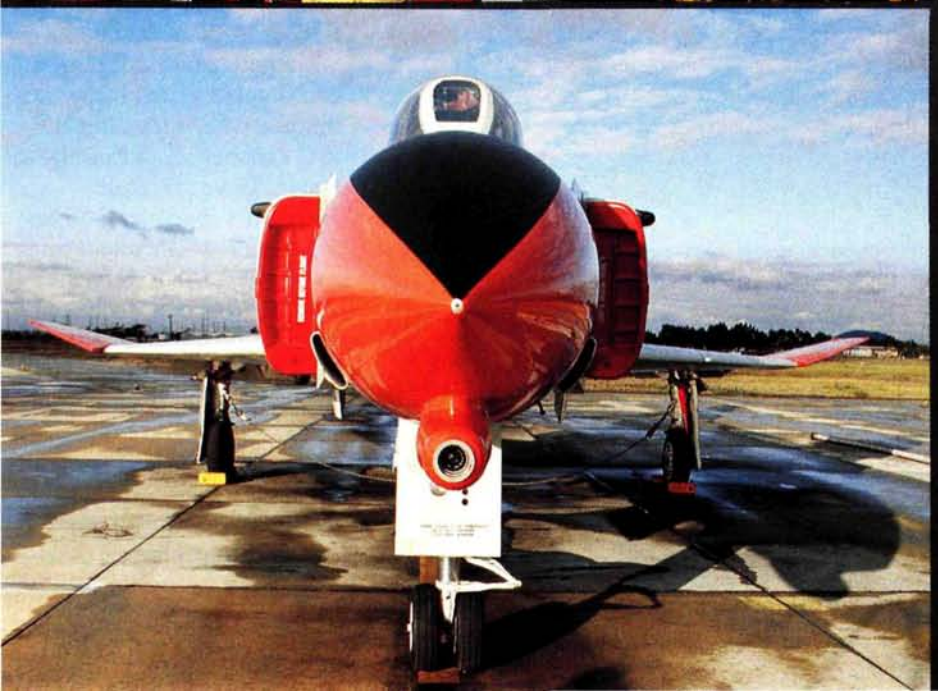
A Phantom and QF-86F Sabres on the flight line.

■ Left: Ensign Nolo pilots an F-86 in a flyby of San Nicholas Island.
■ Below left: Firebee R/C telemetry close-up.
■ Below right: A Ryan BQM-34S Firebee—a sub-scale target drone.
■ Bottom: A close-up of a QF-4N nose with a camera pod.

WHAT'S THE ULTIMATE R/C experience? If you were to pose this question to a number of R/C enthusiasts, you'd probably get a wide range of answers. Some would say that flying a heavy-metal warbird model to a Top Gun victory would top the list; others would say that piloting a large model such as Byron's 20-foot-wingspan B-17 would take the prize.

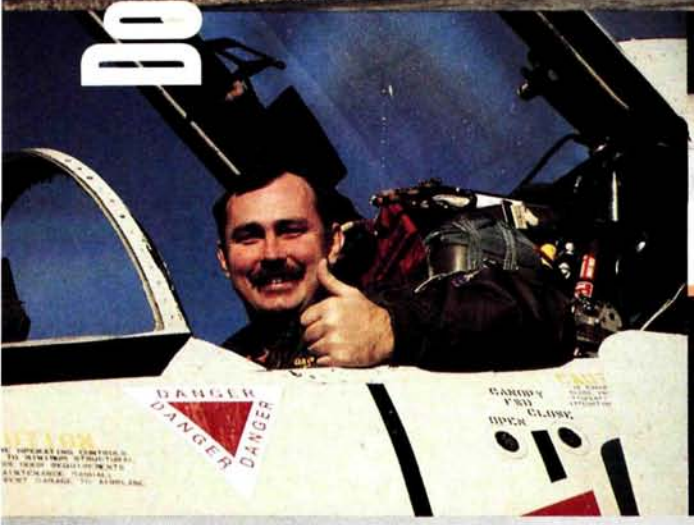
I think I found the answer to the question at the USN Pacific Missile Test Center at Pt. Mugu, CA. The Navy and civilian personnel at Pt. Mugu "present" a variety of remote-controlled target drones to Navy pilots for operational training or the development of new missile systems. Although the contests may seem a little one-sided, the combination of highly trained R/C pilots and sophisticated on-board computers that are capable of jamming missile tracking systems make the targets extremely difficult to hit.



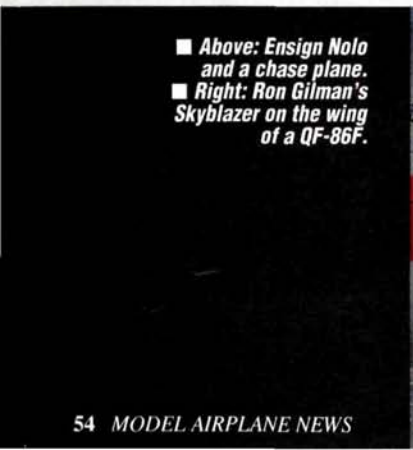


Full-Scale RC tests pilots and weapons systems

Boomed Squadron



■ *Top: Ensign Nolo touches down in a "bounce test" while "White Mouse" rides shotgun.*
■ *Left: Lt. Cmdr. Dave "Fireball" Hayes at the controls of a QF-4N Phantom target plane.*
■ *Above: Instead of the usual "kill" markings, the target scores a victory when the missile misses! From left to right: Aim-9 Sidewinder, Aim-54 Phoenix, Aim-7 Sparrow.*



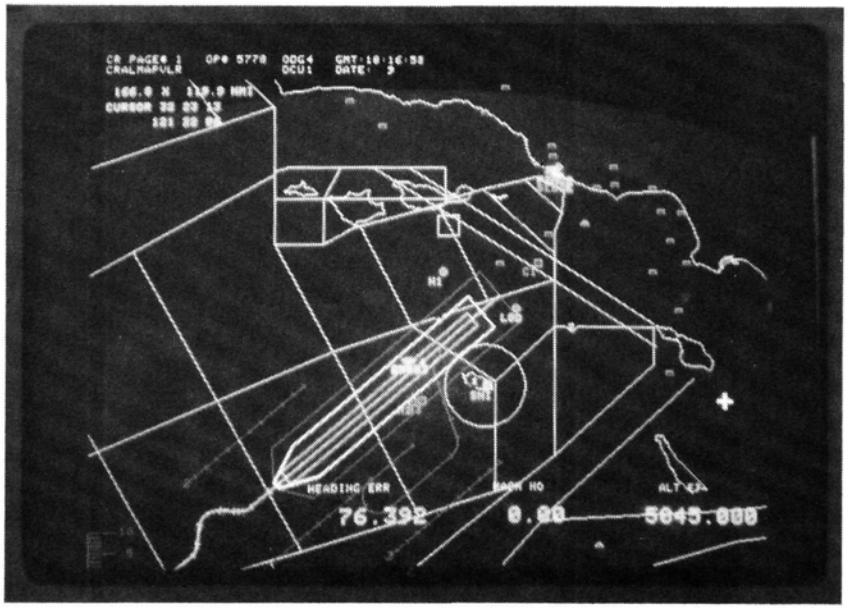
■ *Above: Ensign Nolo and a chase plane.*
■ *Right: Ron Gilman's Skyblazer on the wing of a QF-86F.*

FULL-SCALE R/C

Known as "sub-scales," the target drones range in complexity from a simple towed platform to the 1,500-pound, 12.9-foot-wingspan Ryan Firebee. The workhorse of the Targets Directorate, the Firebee is capable of Mach .97 speeds; it has an operational ceiling in excess of 60,000 feet; and it can remain aloft for almost two hours at high altitude. It's large enough to carry aluminum chaff, electronic jamming pods and flares designed to deceive heat-seeking missiles.

"A panic button enables the White Mouse to take control of the aircraft if needed"

As sophisticated as the Firebee is, there are times when only a full-scale target can simulate actual battle conditions. What's the ultimate R/C experience? According to Cmdr. Dave "Fireball" Hayes, it's flying an F-86 Sabre or an F-4N Phantom *from the ground*. Cmdr. Hayes, who was given his nickname after the brakes of his F-8 Crusader caught fire on his first solo flight, is a graduate of the Navy's Top Gun school in San Diego, CA. He puts all his skills to work when flying the full-scales from a mockup of an F-86 cockpit.



A close-up of the computer graphic map for Nolo operation. The blank areas on the grid show the clear "buffer" space around Nolo operation. The small squares are other aircraft.

"The 4,000 hours of flight ime that I have don't relate a whole lot to flying from the ground," says Hayes. "There's no feel [sic] of cockpit motion, no sounds associated with the aircraft. It's a little more challenging than flying inside the airplane, especially andings."

Although the mockup is equipped with a stick, a hrottle, and basic instrumentation, flying is mainly accomplished by viewing a televiion monitor that receives a picture transmitted from the aircraft. The 30-degree view rom two cameras (one in the ose and one in the cockpit) is he pilot's only real link with he aircraft for maneuvers uch as landings and takeoffs. A third monitor displays a omputer-generated graphic nap of the airspace and ter-

"Mo" Jones (a civilian Nolo pilot) in the seat of an F-86.

ain in the vicinity of the aircraft, and this is useful in orienting the pilot with respect to he location of land masses and ther aircraft in the area.

RAINING ENSIGN NOLO"

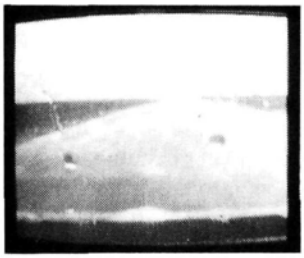
When an aircraft is remotely iloted, it's said to be under the ommand of "Ensign Nolo,"—n acronym for "No Live Operator." Before Ensign Nolo an fly, his human counterpart must qualify and re-qualify for the operation by "bounce testing" his aircraft in the two weeks before the real thing. Bounce testing (or "touch and gos," in our lingo) must be done with a safety pilot riding shotgun inside the aircraft. The "White Mouse," as he's called, must sit in the cockpit (with white knuckles, at times) while the remote pilot practices takeoffs and landings. A panic button enables the White Mouse to take control of the aircraft if needed, in much the same way as the buddy-box system works at your local flying field.

When the pilot has gained hands-on proficiency with the particular aircraft slated for the operation by flying it from the inside and from the ground, Ensign Nolo is ready to go. On the day of the mission, a pilot flies the aircraft from Pt. Mugu to San Nicholas Island, which is approximately 60 miles off the coast. The pilot gets out, the aircraft is refueled, and Ensign Nolo takes over. The aircraft rolls down the 10,000-foot runway, becomes airborne, and the operation begins.

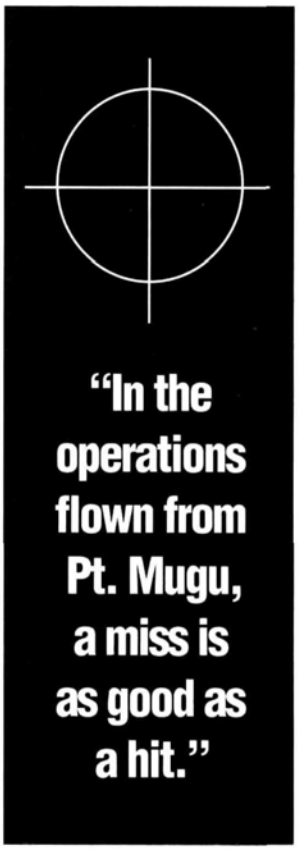
FAILSAFE SYSTEM

When Ensign Nolo is in charge, the command center at Pt. Mugu goes into action. Hunched over banks of computer terminals, very intense men and women direct the players involved in the operation. Communication links with the pilots, telemetry, local air-traffic controllers and the operation controller are closely monitored.

The electronic systems involved are incredibly complicated, and they occasionally malfunction. What happens when a pilotless F-86 or F-4 Phantom jet suddenly loses its controlling signal from the ground? The on-board failsafe

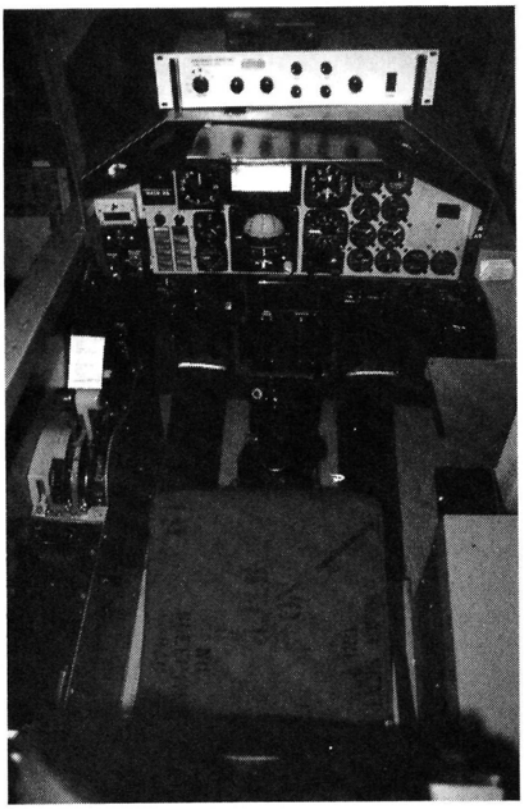


Touch-and-go's using a TV screen?!



Doomed Squadron

A QF4-N Phantom with Ensign Nolo at the controls over Point Mugu. "White Mouse" rides shotgun.



UCC—a universal-command console (Ensign Nolo's cockpit).

system takes over, of course! The computer directs the servos to a preset heading of 220 degrees west and a 10-degree climb to 50,000 feet. Gyros stabilize the ailerons, and the aircraft flies straight and level until radio authority has been reestablished. (With the advent of the latest generation of radios on the market, some of our models have the same capability.)

Failsafe systems aren't foolproof, however. On a recent operation, two Nolo aircraft and two piloted chase aircraft were returning to San Nicholas, low on fuel. The four were in a landing pattern, with one of the Nolos about to touch down. Suddenly, the F-86 went into failsafe and immediately raised its gear and flaps, turned toward the west and began to climb. The other Nolo aircraft also went into failsafe, and for a wild—but brief—moment, all four aircraft were flying directly at one another! Fortunately, control was re-established and no harm was done.

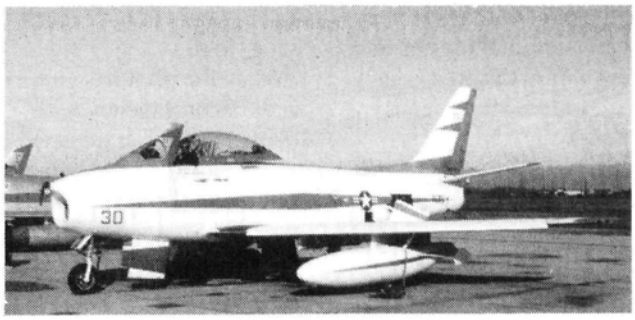
HOT-DOGGING AN F-4

The most recent operations have involved testing the new and improved F-14D Tomcat, which has been used extensively in the Persian Gulf conflict. Since the military budgets were cut by Congress, even the sub-scale target drones have become precious. Telemetry electronics have become so accurate, however, that weapons systems can be calibrated to aim for a predetermined point in the air, relative to the drone.

In the operations flown from Pt. Mugu, a miss is as good as a hit. Occasionally, for a variety of reasons, an air-to-air missile actually hits the full-scale target. Even though the missile's warhead has been replaced by a telemetry payload, on impact, it does considerable damage to the aircraft. If the damage is deemed to be serious enough to jeopardize a safe landing at San Nicholas, the aircraft is destroyed "aerodynamically" by flying it into the ocean at high speed. This is the moment when the "ultimate" R/C experience reaches its peak—hot-dogging a 30,000-pound F4 Phantom! Consecutive rolls; outside loops; 10-G maneuvers, nose-down into the sea at 600 knots!

DOOMED SQUADRON DWINDLES

In the not-too-distant future, the supply of F-86 Sabres will



A Japanese QF-86F on the flight line.

run out. According to Cmdr. Bob Williams, who's in charge of full-scale presentations for the Targets Directorate, only 20 of the Korean War veteran jets remain in flying condition in the combined armed forces. In a normal Navy squadron, 170 young mechanics keep 12 airplanes in top flying form; at Pt. Mugu, 53 maintenance people (average age: 40) do the same job on 14 aircraft; and despite their heroic efforts, attrition has claimed 90 percent of the nearly 200 F-86s used as targets since the program began.

"...attrition has claimed 90 percent of the nearly 200 F-86s used as targets since the program began."

When the Sabres have all been destroyed, they will be replaced by F-4S Phantoms, of which there are many. I suggested that the Navy sell the Sabres to collectors and use the money to buy more Firebees. It seems a shame to sacrifice them all as targets, especially since an F-86 has a difficult time simulating the evasive maneuvers of even the older aircraft that are likely to be encountered in combat. Cmdr. Williams said that he would try to donate the last F-86 to the Navy Air Museum; and I contacted the folks at the Chino Air Museum (who keep their vintage aircraft in flying condition) and told them who to talk to at Pt. Mugu. Let's hope some of these historic aircraft can be saved. ■

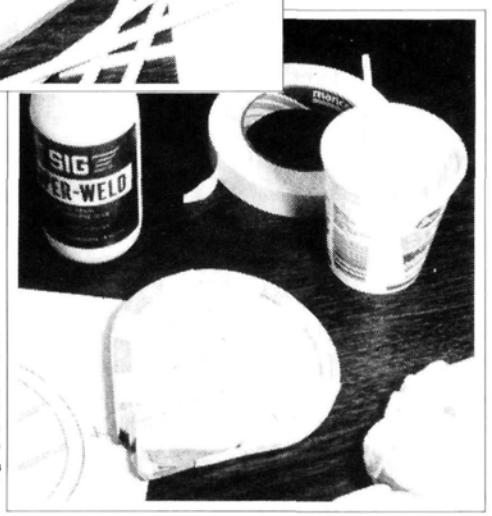
BUILDING MODEL AIRPLANES

by JOE WAGNER

MAKE THE lightest, strongest, neatest curved outlines for model aircraft parts (e.g., built-up wing tips and tail surfaces) by *laminating* many strips of thin balsa. Laminated outlines are easier to make, prettier and lighter than those made from odd-shaped bits of sheet balsa—and they're twice as strong. To get these results, however, you have to use the right method. Several curved-outline laminating procedures have been described in model airplane books and magazines. I've tried them all and have never been truly satisfied with any of them. Instead, I've come up with a new method that's far better than the previous ones. Here it is—step by step.

- Transfer the pattern of the part's inner contour onto a scrap piece of pine. (See the sidebar for a good way to do this.) Accurately saw and sand the wood to shape, and then smoothly wrap its outer perimeter with Saran Wrap plastic film or a similar plastic film.
- From light sheet balsa, cut strips of the same width as the form thickness. Cut enough of them to provide the maximum outline width you need, plus a little extra for final-sanding to the exact outer contour. For gentle curves, 1/16-inch-thick balsa laminations will do; for more pronounced curvatures, use 1/32-inch-thick wood.
- Soak the balsa strips in hot water for 3 or 4 hours. (For strips less than 1 foot long, a 5-quart bleach jug is

To make the laminating form, "rubber-cement" a photocopy of the pattern onto a piece of scrap hardwood, and carefully saw and sand it to shape.

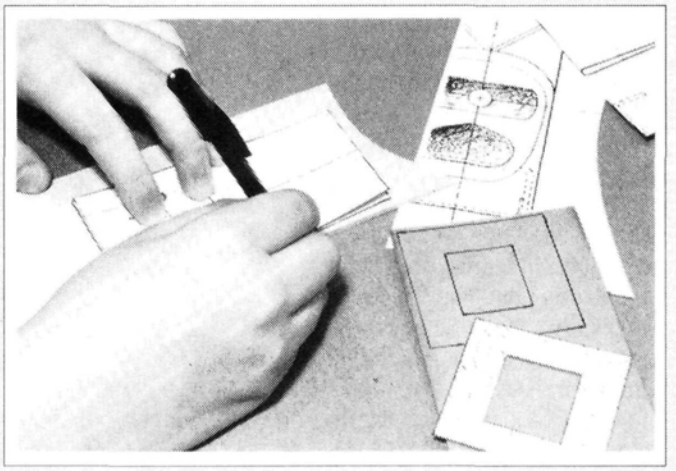


When the the balsa strips have been laminated, masking tape squeezes the layers together firmly, without leaving gaps.

TRANSFERRING PATTERNS

Many modelers hesitate to scratch-build planes because they don't know of an easy way to transfer part patterns from drawings to wood. Although there are several transfer methods, most are so awkward or tedious that they discourage would-be scratch modelers. In my long model airplane career, I've used every known transfer process: pinpricks; carbon paper; rubber-cementing outline tracings directly onto wood; making heat or solvent transfers from photocopies—all of these work, but there's a much better way!

Take your plans to a copy shop, and have copies of all the model part outlines made onto card stock. Cut the component shapes out (precisely *on* the printed lines) using barber shears



Tracing around patterns that have been photocopied onto card stock is an easy way to transfer parts contours from full-size plans to wood.

or scissors of similar sharpness. Now you can put the card-stock patterns onto the balsa or plywood stock and trace around them with a fine-tip ballpoint pen. (Pen markings show up on wood far more clearly than pencil lines, and this will help greatly when you cut and sand the pieces to shape.)

To guarantee the accuracy of the model parts you've made, use the card-stock patterns as templates. This will ensure that each component matches the original plan precisely. When you've completed the model, save all the patterns in an envelope. They might come in handy if, owing to an unplanned landing, you have to build, say, a new fuselage!

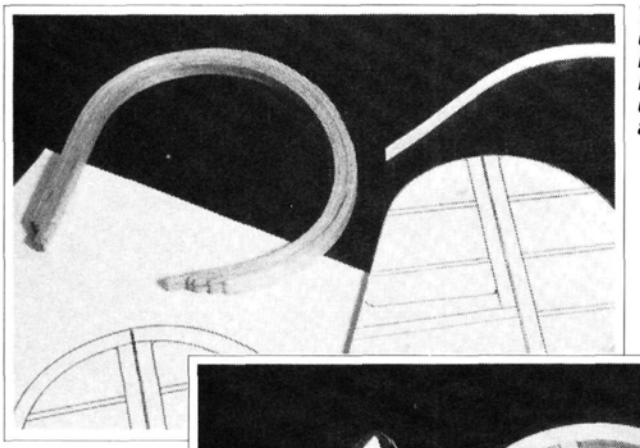
ideal. Fill it to the brim with hot water; insert the strips one by one; then put the jug's top on.)

• Remove one strip from the water, "squeegee" the water off it with your fingers, and then pin one end of it to the form, about 1/2 inch ahead of where the contour starts. Slowly and carefully form the wet strip around the mold tightly. Temporarily hold it in place with pins and one or two rubber bands.

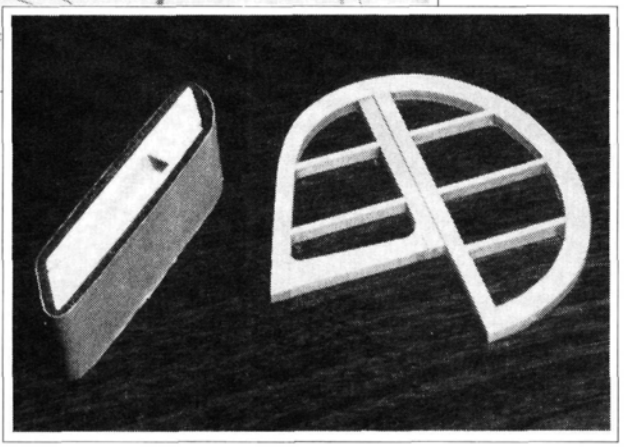
• Brush a coat of Sig's* Super Weld white glue smoothly over the first strip. Put a second strip on top of the first, removing and replacing the pins and rubber bands as necessary. Repeat this procedure until all the strips have been wrapped snugly around the form. (This is a messy procedure. Keep plenty of wet paper towels handy to wipe off the excess glue that oozes out!)

• Cover the laminated balsa with a strip of polyethylene plastic (cut out of a bleach jug). Clamp everything together by wrapping many short pieces of masking tape around the laminations and firmly attaching the tape to both sides of the form.

• Let this assembly dry for a day or so, and then remove everything from the mold. When you've trimmed and sanded the glue-encrusted edges until they're smooth, the outline will be ready for the addition of the inner ribs, spars, etc.



This laminated outline has just been removed from its form. (Notice the outer plastic strip at the top right.)



The outer contour and inner structure are complete. This vertical tail assembly is now ready to be shaped into a streamlined cross-section, and then separated, covered and hinged.

• For duplicate parts (i.e., the wing and stabilizer tips), make the laminating strips wide enough to produce as many as you want. A balsa stripper works well to slice the individual parts out of a thick laminated "blank."

If you follow these directions exactly (i.e., don't use ammonia in the soaking water; don't substitute another brand of glue), you'll end up with beautiful, incredibly light laminated parts that are as tough as tennis-racket frames.

**Here's the address of the company mentioned in this article:*
***Sig Manufacturing Co.**, Inc., 401-7 S. Front St., Montezuma, IA 50171* ■

VICTOR ENGINEERING

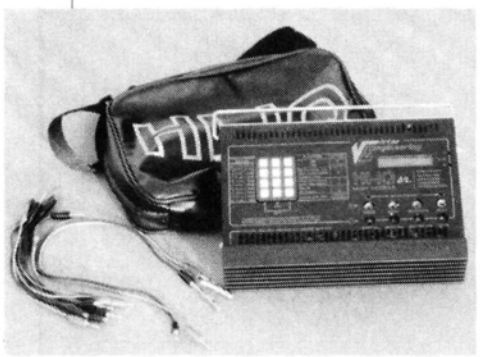
HI-IQ

SEE INSIDE YOUR BATTERIES

by JOHN LUPPERGER

WOULD YOU LIKE to have a high IQ? Who wouldn't? Well, now you can, and it has nothing to do with being a genius.

Victor Engineering's* HI-IQ is a computerized, multi-function, Ni-Cd conditioner, tester and analyzer. It comes in two versions: the HI-IQ Standard and the HI-IQ Senior. The Standard has eight functions; the Senior, 15. Both units are capable of using additional software and hardware, as well as new accessories that are constantly being developed by Victor Engineering. The company has a Software Update Club for HI-IQ owners (there's a small charge).



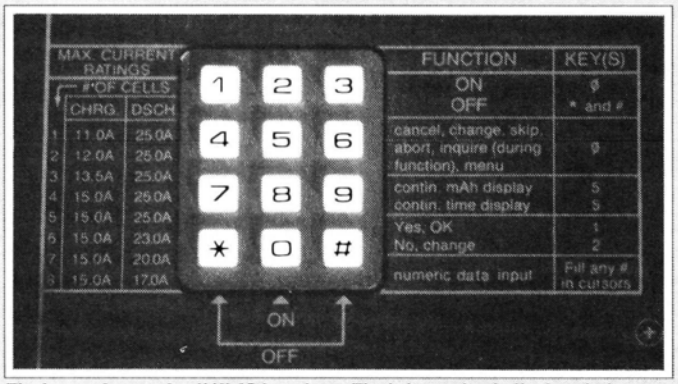
The HI-IQ Senior comes with all the necessary jacks and a customized carrying case.

The man behind all this electronic wizardry is Victor Kmosek, the owner of Victor Engineering. He has a masters degree in electronics, and he has applied his extensive knowledge to his hobby and his company.

I wanted to get a HI-IQ because my experience has shown me that many of the electronic gadgets made for the R/C car fraternity—and I think the HI-IQ was originally aimed at them—can benefit electric fliers. I read all the *Radio Control Car Action* articles on speed controllers, batteries, motors and chargers, often finding the information relevant to electric flying.

HI-IQ STANDARD OR SENIOR? — YOUR CHOICE!

The Standard or the Senior? Your choice will depend on how many HI-IQ features you think you can use. Both have eight basic features:



The key pad controls all HI-IQ functions. The information it displays helps you to get started and continue.

1. Linear constant-current charge with peak or timed cutoff up to 15 amps; with default or fully programmable parameters.

2. Trickle-charge: 80mA.

3. Linear constant-current discharge. Timed or voltage cutoff, defaulting at 10 amps, or programmable up to 20 amps for 2- to 6-cell packs. Single-cell and 7-cell packs typically yield 17 or 18 amps, and 8-cell packs, 15 amps.

4. Discharge-charge-discharge cycling with up to 99 cycles, all fully programmable with peak-charge and timed cool-down periods.

5. Battery grading/matching. This is a computerized cell or pack tester/grader with default or fully programmable parameters.

6. Quick battery test: takes 3 to 4 minutes.

7. Motor/gear current-draw test.

8. Digital voltmeter. This can be used externally.

On the Senior, these basic functions are enhanced, and there are seven additional ones:

9. Thermal push-charge. This has a linear constant-current charge with programmable thermal cutoff up to 15 amps, with default or fully programmable parameters (the thermal-probe option is necessary).

10. A 25A discharge mode for 1- to 6-cell packs; 21 amps for 7-cell packs; 17 amps for 8-cell packs.

11. Thermal cycling. There's a choice of thermal or peak-charge, and thermal or timed cutoff during cool-down (the thermal-probe option is necessary).

12. Shocker/revival. This is used to revive cells that have deteriorated or to "top" charged packs just before they're used. It includes an electronic stopwatch.

13. Motor and gear break-in cycler.

14. Digital thermometer. Thermal software is standard, but the thermal probe is optional.

15. Enhanced software with special "Quick Keys" for ease of operation.

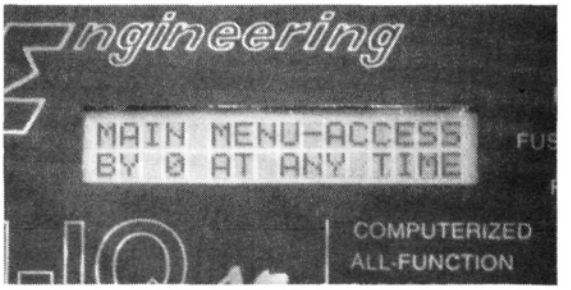
Seniors come with all the necessary cables for hook-up and operation. As if all these weren't enough, there are additional hardware and software options that can make your HI-IQ do everything but sing! The other hardware and software features that are, or will be, available include:

- Thermal probe
- Automatic maintenance of peak temperature
- Motor-commutation test
- Multiplexer for use with up to eight packs sequentially
- Tachometer and frequency counter
- Computerized motor dyno
- Transmitter frequency checker
- Speed-controller tester
- Printer and PC interface
- Charge/discharge graph software
- PC communication software
- Lap-counting system
- Stand-alone power supply

HI-IQ

USER FRIENDLY

When I received my HI-IQ Senior, my first impression was that they'd forgotten to include instructions. The literature that came with it appeared to be advertising hype about all the wonderful things it could do, but there was no information at all on how to use it. Not wanting to damage such a sophisticated piece of equipment, I called Victor Engineering. The people there assured me that I only had to *use* my HI-IQ to learn about it.



Its LCD display literally teaches you how to use your HI-IQ; it eliminates the need for detailed operating instructions.

This sounds almost too simple, but it's really the case. A basic understanding of the HI-IQ's features is all you need, because its LCD display tells you what to do. If you're unsure of a setting, the default settings for each function will work quite well. If you decide not to buy a Victor Engineering IQ-Power-1 power supply, a 12V battery or a 12V auto-battery charger "power supply" will do the job, although with some limitations. I found that a 12V deep-cycle marine battery was good enough for the functions I engaged.

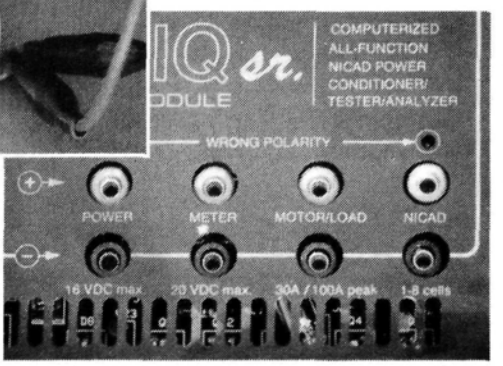
HI-IQ FUNCTIONS

The HI-IQ's most important feature is its ability to measure precisely the capacity and performance of cells or batteries. This enables you to know exactly what you're flying with. It also allows the grading and matching of cells—one of the HI-IQ's most significant uses.

• Grading and matching batteries. As an avid electric flier, I've collected a lot of battery packs over the years. I try to fly in as many electric competitions as I can, and I'm always trying to identify my best packs for competing. I decided to grade and match my 900mAh SCR packs (I had seven, 7-cell packs to work with).

This is how you isolate a single cell for testing and grading. Two of the leads are for charging/discharging, and the other two are for the internal voltmeter.

I first cycled each pack 10 times to bring them up to their full potential; then I tested and graded each cell individually. This took several evenings. I gave each cell a number and a letter to identify the pack from which it came, and I loaded all the grading information from the HI-IQ into a spreadsheet in my computer. Although the HI-IQ also records voltage data on cells, I recorded mAh data as the basis for matching packs. Having matched cells based on mAh capacity, you can secondarily group cells according to the highest discharge voltage. Equipped with these mAh figures, I graded and built new "matched" packs. I had only 49 cells; more would be needed for top-grade matching. (This is because measurements of Ni-Cd cells fall into the normal distribution "bell" curve, and to find a few cells with extraordinarily high capacity, you have to test quite a lot.)



The jacks for hooking-up a power source, a Ni-Cd battery, a motor and meter are all clearly marked.

(Continued on page 88)

LCD MENUS SIMPLIFY USE

HI CHAMP!
I'M HI-IQ SENIOR

MAIN MENU ACCESS
BY 0 AT ANY TIME

SAMPLE CHARGING MENUS	SAMPLE CYCLING MENUS
CHARGE=1✓ DISCHARGE=2 CYCLE=3	CHARGE=1 DISCHARGE=2 CYCLE=3✓
PEAKED=1✓ TIMED=2 TRICKLE=3 THERMAL=4	NO. OF CYCLES=10 OK=1✓ CHARGE=2
C OR D CELL=1✓ AA OR OTHER=2	DISCHARGE CUTOFF @ 6.65V OK=1✓ CHARGE=2
NO. OF CELLS=6 OK=1 CHANGE=2✓	TIMED COOL- OFF=1✓ THERMAL COOL- OFF=2
NO. OF CELLS=❑ ENTER 1 TO 8 MAX	AFTER-DISCHARGE COOL- OFF: 1 HR, 30 MIN
CHARGE RATE=❑❑.❑ A ENTER 00.1 — 15.0	DISCHARGING @ 3.83A ON CYCLE NO. 1 OF 10
CHARGING @ 3.80A 00:00:24 10.30V	CHARGING @ 3.82A 00:00:19 10.10V

PHOTOS BY EDWARD DUCOTE

An ideal electric trainer

Thunder Tiger Gull

GLOBAL HOBBIES

by EDWARD C. DUCOTE

CRAFTSMEN UNITE! It was once true that to have a sharp-looking model that flew "right off the workbench" you had to pay some dues. You needed years of experience and spent hundreds of hours meticulously handcrafting your "labor of love."

Well, I'm glad to announce those days may be numbered. You can still spend countless hours whittling away while your buddies are out flying, or you can put in an 8-hour evening and fly with them tomorrow.

When I decided to "assemble" an ARF, certain criteria were important to me:

- *Electric!*—quiet, clean and versatile
- *Trainer*—easy to fly and gentle behavior
- *Sailplane*—ability to thermal and soar.
- *Quality*—an airplane I'd be proud to fly

After shopping around, I found that the Gull 1900 Electric fit this profile. Manufactured by Thunder Tiger and distributed by Global Hobby Distributors*, the Gull is a beginner/intermediate electric-powered sailplane that looks hand built and, with a little attention to detail, will "fly right off the workbench."

Preflight prep is quick and easy, and the battery pack just slides in—no problem!

Thunder Tiger Gull

SPECIFICATIONS

- ***Type:*** *ARF electric-powered sailplane*
- ***Wingspan:*** *74.5 inches*
- ***Wing Area:*** *612 square inches*
- ***Length:*** *37.8 inches*
- ***Weight/Wing Loading:*** *50 ounces/11.7 ounces per square foot (with 6 cells)*
- ***Motor:*** *Direct-drive bushed 0.05 can-type with capacitors*
- ***Propeller:*** *8x4.5 Graupner* folding prop plus spinner*
- ***Battery Req'd:*** *6-cell, 1200mAh Ni-Cd (7-cell optional)*
- ***No of Channels Req'd:*** *3 (two miniservos; speed controller)*
- ***Suggested Retail Price:*** *$179.95, or mail order through Global Hobby Distributors: $119.95*
- ***Features:*** *the ARF Gull was specially designed for electric operation and requires only minimum assembly. The motor, folding prop and spinner, mounting hardware and pushrods are included, and the plane is finished with PVC film.*
- ***Comments:*** *to complete the Gull, you'll need epoxy and CA glues, basic tools, a 3-channel radio, two miniservos, a speed controller and about 8 hours of free time. The result is a quiet, clean sailplane that's easy to fly and a good first trainer.*

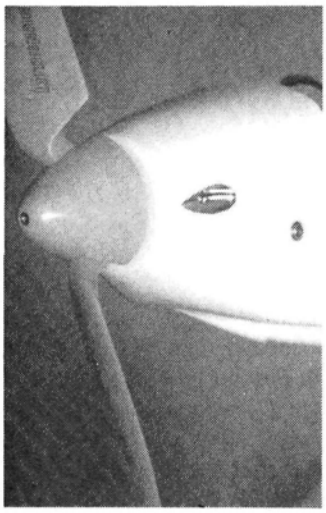
THE KIT

The first thing that grabbed my attention was the box—eye-catching graphics, and information and specifications were easy to find. Inside, the packaging was equally impressive. A 1-inch slab of Styrofoam sandwiched the wing panels and tail surfaces, and each piece was individually wrapped in a heavy plastic bag. A cardboard piece separated the fuselage and cowling from the more delicate parts, and the hardware was in a separate, smaller box at one end of the main box. The smaller box included the motor, the folding prop and spinner, the control hardware and screws, dihedral braces and a canopy. Pushrods are of balsa and wire, but they're separated to prevent the wire from puncturing the balsa. The motor is a direct-drive, bushed .05 can type with two noise capacitors already soldered onto the power lugs. The two-part, clamping, metal motor mount is light, yet strong.

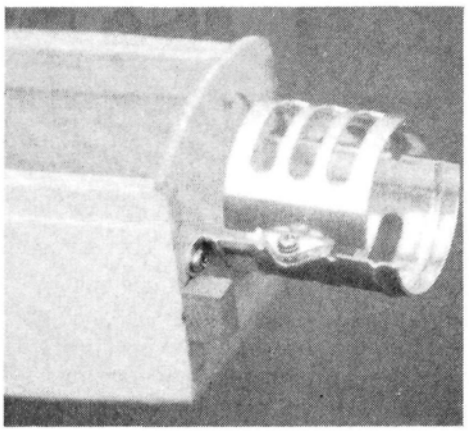
As you'd expect in an ARF, all surfaces were already covered—glossy white PVC film. This covering looks good, but it's very soft, so extra care must be taken to avoid damaging it when you handle and fly the aircraft. On some areas of the wing panels, the film was slightly slack. A *gentle* heating will tighten it, but watch out! Use extreme caution and very low heat (an iron or a heat gun). This film will cause even the most crafty film-flinger to cry.

Colorful graphics abound, and there's a large sheet of decals with which you can finish the Gull's "wild surfer" look after final assembly. Note the two large pink patches on both wing tip bottoms. They should help you orient the aircraft when it's at altitude.

I had two construction problems: one wing-tip trailing edge was badly warped

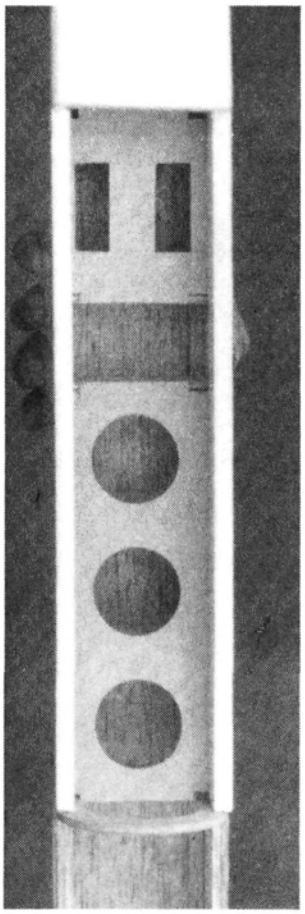


A Graupner, folding, Scimitar prop is a smart choice, because it decreases drag while the sailplane is gliding. Note the air inlets in the plastic cowling.



The two-piece motor mount is strong yet light. Downthrust is built into the firewall.

"...a quiet, clean sailplane that's easy to fly and a good first trainer."



Radio bay has enough room, but all the space is used. The servo tray is made for miniservos, but it can be trimmed to accept others.

Thunder Tiger Gull

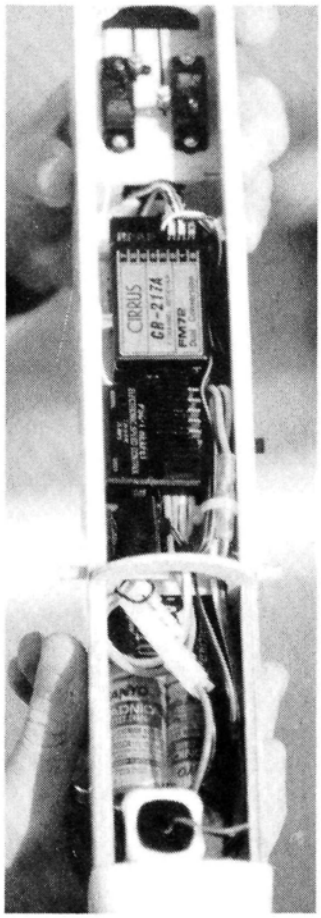
downward. I tried to straighten it with heat, but I wasn't successful. Later, this caused some minor problems with trim. The second problem concerned the main wing tips and their dihedral. Where the main panel and tip join, only the tip rib is angled, so the upper edges and the airfoil don't match well. (This makes for sloppy construction, but it works out OK.)

ASSEMBLY

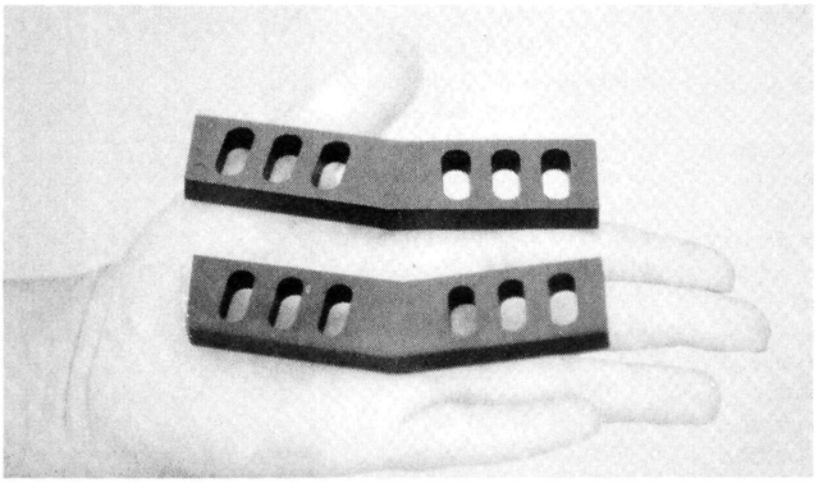
Since this plane is almost ready to fly, I'll spare you the details and outline only my changes or additions.

- Read the manual—twice! Now, unpack everything, identify the pieces and take inventory with the parts list given on page 2.
- When you install the motor mount, position the two horizontal screw lugs above the hardwood extensions.
- I used the supplied canopy decal, but it has many wrinkles. It may look neater if it's painted on.
- When you glue the bottom skid on, note its proper location (shown on page 8). Its forward point should extend to just inside the motor cowling. Also, mark, cut and peel away the PVC covering under the skid before you glue. If you do this, the skid won't come off.
- Attaching the tail feathers is quick and easy. Be sure to get them straight and square, and double-check their alignment while the epoxy is setting.
- Before gluing the dihedral braces into the wing, look closely at both, and check that the sweep angle goes back at the tip panel. Lay the main panel on a flat building board; and line-up the bottom edges of the root and tip panels. Hold the tip in position with a block or a large dowel. Measure dihedral at the tip. Important!: both tips must be equal in angle from the horizontal.
- The strip of ABS that's intended to strengthen the trailing edge where the rubber band goes just wasn't strong enough to prevent crushing. I made a stiffer cover out of .010 inch shim metal, which is very strong and light.
- Where do the pushrods go?! There were no exit holes, so I made the rudder exit at the top right of the fuselage and the elevator exit at the rear. I had to shorten the rudder pushrod by approximately 3 inches to make it fit. The elevator hole doubles as a much-needed cooling vent. (I was surprised not to find any provisions for cooling in this model.) I also cut a 1-inch-square vent in the bottom of the fuselage immediately behind the skid. These two vents should provide enough cooling for the batteries and the speed controller.

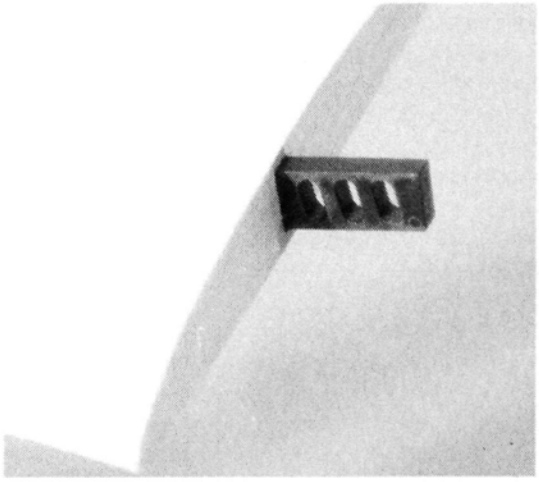
The radio gear went in easily. There isn't a lot of extra space—but enough. The supplied servo tray is meant for miniservos. For control, I installed a Cirrus* radio receiver and servos and a Panda* speed controller, and I used Velcro® tape



The equipment has been installed; the Gull is ready to fly. Note the forward positions of the motor and the receiver batteries. This is necessary to obtain the correct CG.



The plastic dihedral braces are also swept back. Check them closely before you glue them in.



The dihedral brace is easy to install in pre-made slots. Put epoxy into the holes before you insert the brace into the wing panels.

to attach them to the top of the battery tray. Be sure to use a heatsink on the Panda.

With all equipment installed, check the center of gravity. My model was tail-heavy—*very* tail-heavy!—no doubt, because of the strong, heavy wood in the tail structures. Remember, in electric models, you can move components around to balance the plane and thus avoid adding weight. I put the 450mAh receiver battery as far forward as possible and cut out the sides of the no. 2 bulkhead. This allowed me to slide the motor battery along the bottom until the balance was perfect. Use Velcro® tape to hold the motor battery pack in place, because it makes taking the battery out for charging a breeze.

Antenna routing wasn't discussed in the manual. Running it straight out through the rear cooling hole is fine, but I set mine up in the conventional way: out through the top of the fuselage and attached to the fin. Remember, don't trim the antenna, or wrap it around itself!

THE GULL TAKES WING

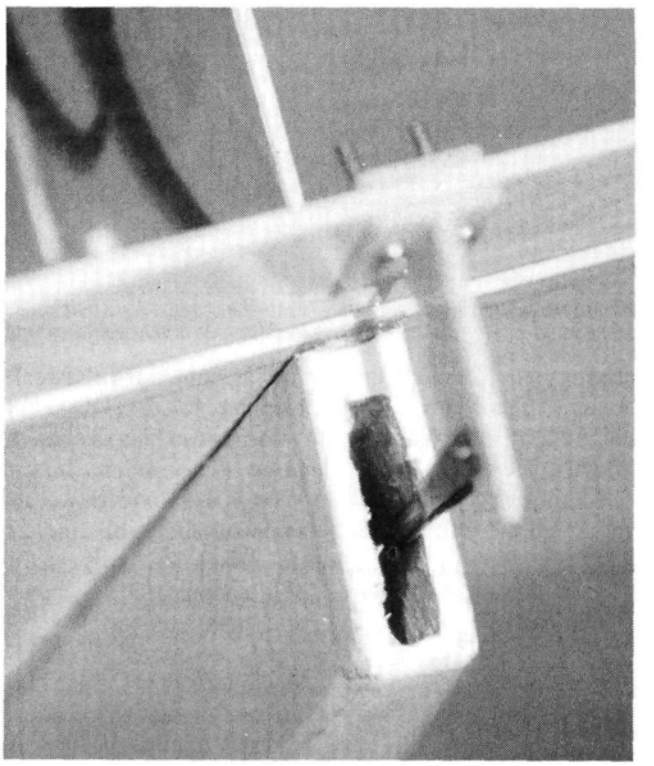
If, like me, you're a beginner, get help from an experienced pilot! It will make the difference between a ruined day and a lot of fun flying.

After a pre-flight check on a calm morning (best for first flights), we launched the Gull. The warped wing tip affected power trim and rudder trim was needed to correct this. Nevertheless, the Gull climbed steadily, and 60 seconds later, I was approximately 250 to 300 feet up—not a spectacular climb, but enough for a beginner and easy to keep up with.

With slight adjustments to glide trim, my sailplane was gliding nicely, so I took the controls and practiced steady, controlled circles and cruising. The Gull responded predictably and forgave my harsh inputs. On the 6-cell, 1200mAh battery, it made two more climbs of almost a minute, and small thermals kept it aloft for a total of almost 10 minutes. In the hands of my instructor, the landing was smooth and slow.

After a couple more training flights, I was launching, soaring and landing fairly confidently. Before I flew the Gull, I had only limited experience with sailplanes and electrics. Now, all I need is practice.

With a 7-cell, 1200mAh battery, the same altitudes can be reached more quickly. I found the powered part of flights easier to control with the extra punch of seven cells. When I blundered into some rising air, the time aloft increased more than 15 minutes! The Gull wags a wing when it's sniffing a thermal, and it's fairly easy to circle it tightly in a column of rising air



The elevator pushrod works best if it exits through the rear. The hole, which had to be cut, doubles as a cooling vent.

"The Gull responded predictably and forgave my harsh inputs."

CONCLUSION

If you're a beginner or just want to get flying fast, the Thunder Tiger Gull 1900 gives you a great way to start. Even if you have only basic assembly skills, you'll be able to build the kit successfully. With its low airspeed and stability, a new pilot should be able to solo after a few instructional flights.

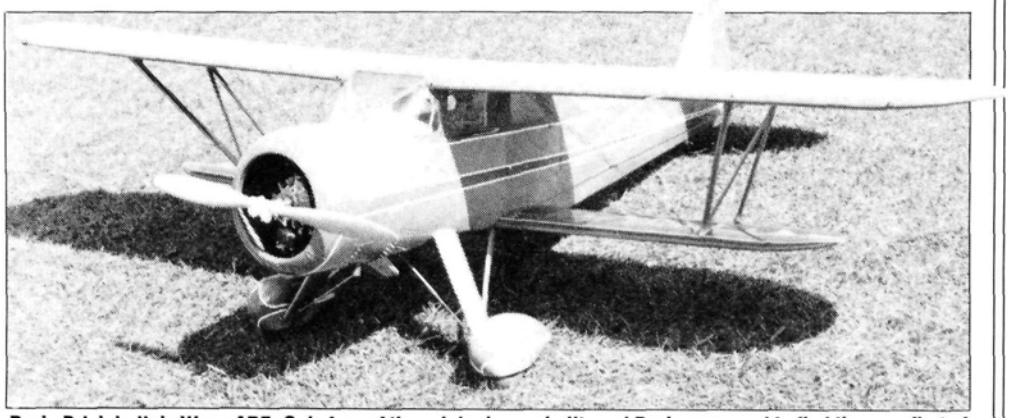
Although the construction materials, procedures and accessories were adequate, I found it surprising that no provisions had been made for cooling the motor, batteries and speed controller. I also think that PVC wasn't the best choice of covering; it looks good, but it's a little heavy and can be easily damaged. Otherwise, the Gull 1900 is easy to fly and a lot of fun. If I can be successful with it, I'm sure you can, too.

**Here are the addresses of the companies mentioned in this article:*
Global Hobby Distributors, *10725 Ellis Ave., Fountain Valley, CA 92728.*
Cirrus; *distributed by Global Hobby Distributors.*
Panda; *distributed by Global Hobby Distributors.*
Graupner; *distributed by Hobby Lobby International, 5614 Franklin Pike Cr., Brentwood, TN 37027.* ■

GIANT STEPS

PLANS; GIANT RIBS AND HINGES

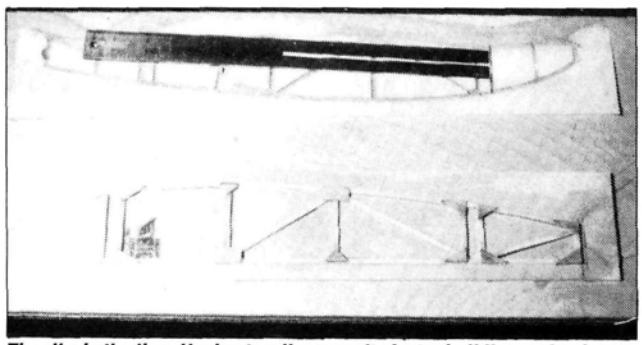
by DICK PHILLIPS



Dario Brisighella's Waco ARE. Only four of the original were built, and Dario managed to find the very first of these within driving distance of his home. The plan is very well-done and produces a model that's true to scale.

WHILE REVIEWING large scale plans for our books, my partner John de Vries and I have taken an exhaustive look at more than 150 of the 250 plans in our collection. As you might imagine, the plans we've written up for our Plans Directories have run the gamut from being very, very good to providing only minimal information for the construction of a model.

We were surprised at the wide variety of models for which plans are available. They include well-known airplanes such as the P-51, the P-40 and the P-47 and WW II "heavy iron." There are some pretty exotic airplanes, too—some of which, few of us have ever heard of. These oddball machines include a Praga Baby, a Gotha Go 150 and a Siebel Si201. The variety provides something for almost everyone who builds from plans.

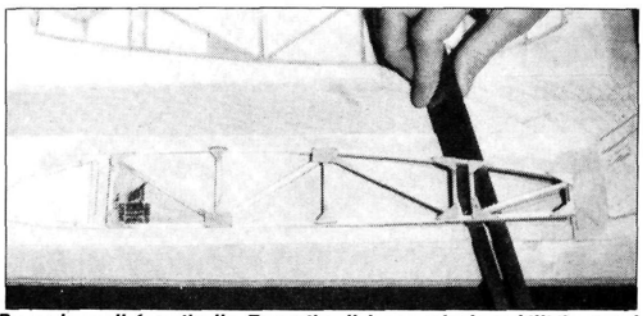


The ribs in the jigs. Having two jigs permits faster building and reduces the temptation to remove the ribs before the glue has cured properly.

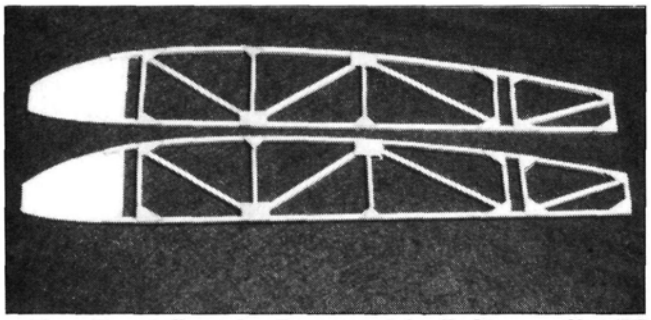
Bob Holman* has been carrying plans from England for some time. Many were designed by well-known, British, scale-model builders. Many are very good and provide all the information that's necessary to build museum-quality models. Bob recently added some of the German plans with which we've been familiar for some time, but have avoided discussing because they weren't readily available in North America. Now they are. If Bob Holman continues to expand his catalogue of offerings, there will be no excuse for any plans builder to despair of finding something to tweak his interest.

American plan designers have also been busy: Wendell Hostetler continues to add to his line, as do Nick Ziroli, Roy Vaillancourt, DP Systems and many others. We recently reviewed Wendell Hostetler's new Cessna 206 for one of our Directories, and it's another beauty. A few designers have stopped working on plans, and it's really a pity. Bob Nelitz hasn't released a plan since his 1/3-scale J-3 Cub, and Dario Brisighella hasn't offered anything recently. (He does have some new stuff, but as I've been asked not to publicize the plan I have, my lips are sealed!) It's really a shame that these two excellent designers have given up plans design.

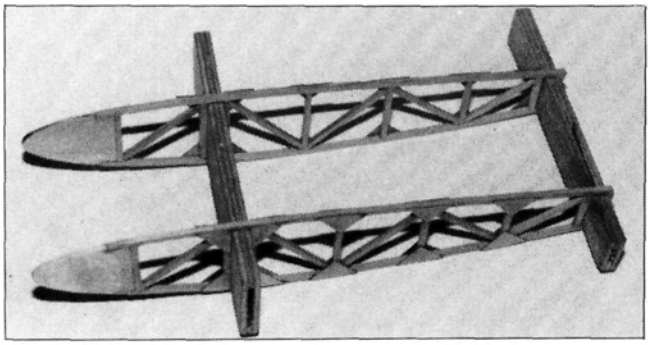
Nelitz's J-3 and Dario's Waco are are fine examples of the designer's art. That both designers have called a halt to releasing their work is a significant loss to us all, and it results partly from the fear of liability litigation that could arise from scratch-building a model. It seems that everyone sues everyone in sight when there's any sort of accident or problem. That this inhibits designers is understandable. There isn't a lot of profit in designing



Removing a rib from the jig. To pry the rib loose, wiggle and tilt the metal ruler.



● *Above: These built-up wing ribs were made in a jig. These are Clark "Y" airfoils at 1/4 scale. Note the vertical spar boxes and the gussets (at every joint).* ● *Below: Ribs mounted on demonstration sections of box spar. The bays between the ribs may be fitted with drag and anti-drag braces made of wire or dowel.*



plans, and selling them is only profitable when the designer or supplier has a large and extensive collection to offer. I don't know of any supplier who depends solely on plans for an income.

With 250 large scale plans in our possession, and with more coming along all the time, we expect to produce at least four volumes of the Directories and, in time, that might even be expanded to five. For more information, contact ViP Publishers, Inc.* for a catalogue (enclose a business-size SASE).

Speaking of SASE's, many of you write to magazine columnists for information. We're delighted to hear from you because it provides tangible evidence that you're reading our columns, and that's appreciated. We don't, however, get a deal on postage, so we really appreciate an SASE with your request. I live in Canada, but if you include a U.S. stamp with your query, I'll always respond and can use your stamps for my own SASEs to the U.S.

HELPFUL HINTS

Built-up wing ribs. I've recently received enquiries about some of the methods I mentioned in my book, "Building Big Is Beautiful,"* and I've decided to discuss a couple of them here. When I first visited Col. John A. de Vries in Colorado Springs some years ago, he was building a Ryan Brougham. He was using a method of making wing ribs that I've since used. It's interesting work that produces beautifully light, strong wings.

The method obviously works best with constant-chord wings. Making a number of jigs for a tapered wing would be a long, arduous job. A jig is made out of a piece of plywood that's overlaid with a small piece of lite-ply that's shaped to provide slots that take the strip stock used for the ribs. The example shown used 1/8-inch-square spruce stock. As you can see from the picture, I make two identical jigs. This allows me to make a rib, glue it, then make another in the second jig. The jigs are then used alternately to make a number of wing ribs in a fairly short time.

To prevent the glue from sticking to the jig and to facilitate the removal of the completed rib, I thoroughly wax the jigs before I start construction. I use the paraffin wax that's used to seal preserving bottles, rubbing it thoroughly into the wood. Then, carefully using a propane torch, I heat the wax until it soaks into the wood. This works quite well to "glue-proof" the jig.

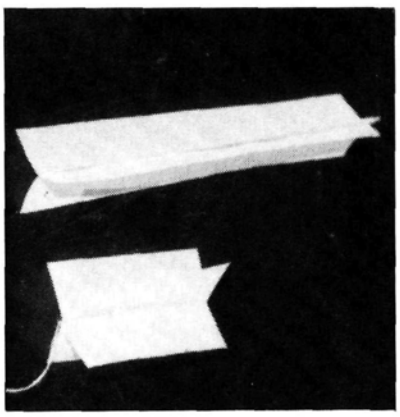
As is obvious in the photo of the completed ribs, you can cheat a little by making the leading-edge section out of flat stock. This type of rib could be made entirely out of strip stock, but you might have to soak or steam the strips to make the tight upper curve just behind the leading edge.

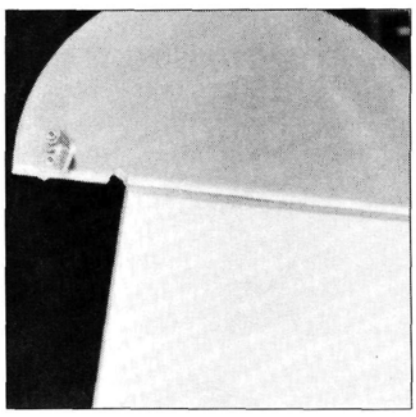
I cut the strip stock to the appropriate length (in quantity) before I start to assemble the ribs. If you cut the bits and pieces first, the assembly goes very quickly. Put the strips (and leading-edge sections, if you use flat stock) into the slots in the jig, and then put a drop of CA at each joint. I use thin Hot Stuff*; it wicks into the closely cut joints and makes them secure.

Then, to each joint, add small pieces of 1/64- or 1/32-inch plywood, cut to shape, as gussets. Before I start, I make a lot of gussets out of scrap plywood (the gussets are quite small). This light plywood can be cut with a pair of scissors or an office paper cutter, which works really well and allows you to cut many gussets quickly.

Glue the gussets into place with medium Hot Stuff, and when it has set, pop the rib out of the jig, and prepare

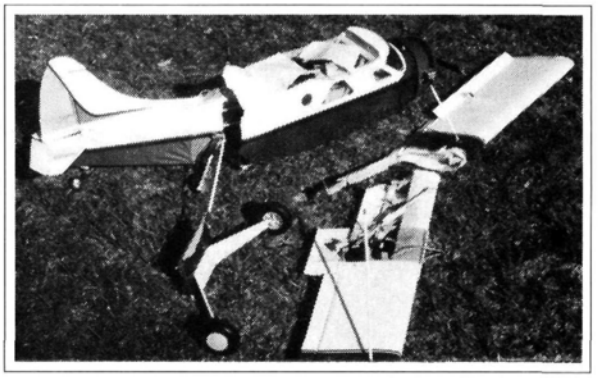
(Continued on page 126)





●*Left: Super Coverite hinges, which may be made in any width or length. They're very flexible and strong enough to take almost any load.* ●*Right: The Coverite hinges on a Giant Ugly Stick rudder. The hinges are totally flexible and almost invisible.*

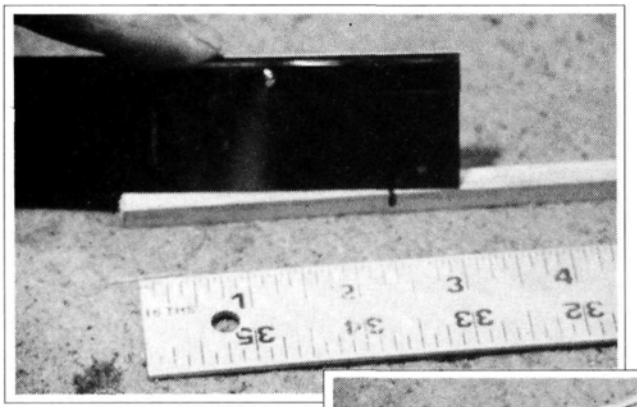
Don't Trash Your CRASH



YOU CAN REPAIR IT

by ROY DAY

AFTER A BAD CRASH, there's a terrible temptation to just dump the whole mess in the trash can. Don't. There's a good chance it can be repaired at minimum expense and in much less time than it would take to build another plane. Here are some helpful hints on how to repair that next crashed plane.



1. The secret of strong and straight repairs: splices that are eight to ten times the thickness of the material. Begin by making the first cut with your saw on the new material.

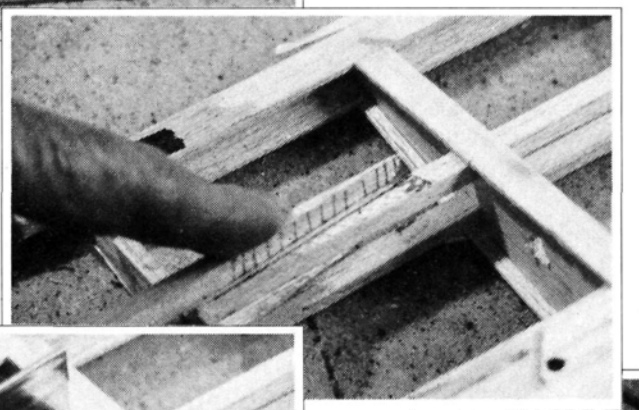
KEEP ALL THE PIECES

First, carefully gather all the pieces at the crash site. Even a scrap of balsa may save you time by serving as a template for a new part. Maybe it can be glued back into place with a doubler.

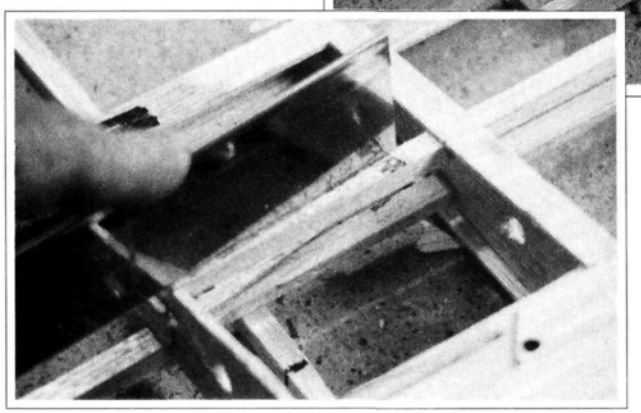
ASSESS THE DAMAGE

Next, remove the radio and the engine, and carefully check them for damage. If none is apparent, then check that both still operate. Do this right away, in case there's a long wait for replacement parts or repairs. It's surprising how today's radios and engines survive terrible crashes.

Assess airframe damage. Remove the covering and sheeting to reveal the "broken bones." Check for loose servo mounts, broken hinges, and wiggle the tail to see if it's loose.

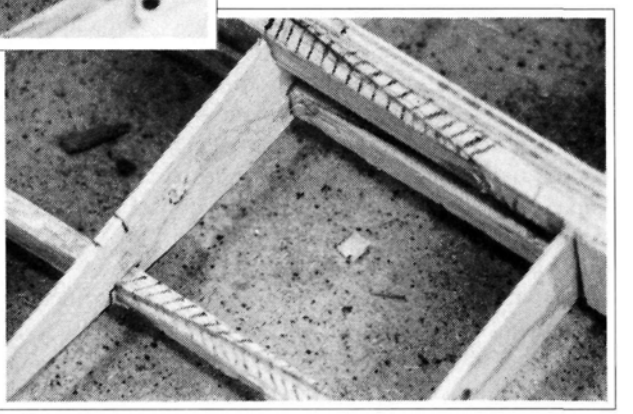


2. Place the new member over the damaged one, and mark it for the mating splice cut.

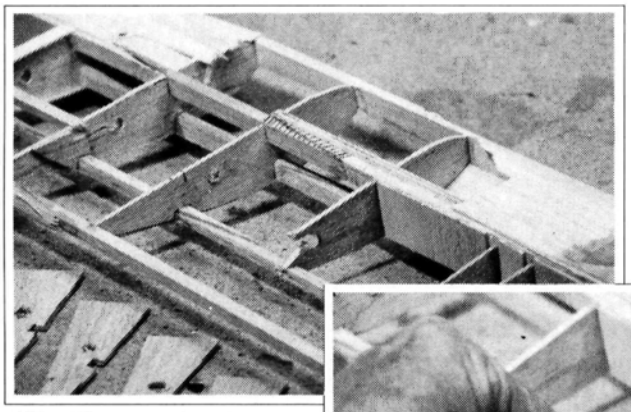


3. Cut the old member as marked.

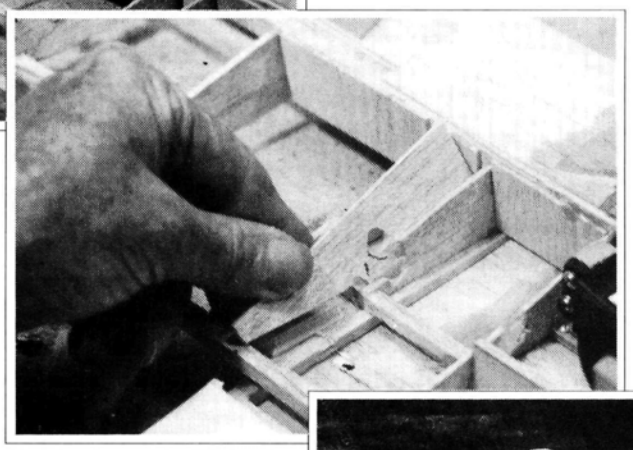
PHOTOS BY ROY DAY



4. Voilà! A splice that's strong and straight (cross-hatching added for clarity).



5. To make new parts, use old broken ribs as templates.



6. Slip the new rib parts into place and glue.

REPAIRING THE BEAVER

Liberal use of doublers can make the repair of damaged lite-ply or balsa-sheet structures generally easier than the repair of damaged stick construction, which often requires splicing. Here, I'll concentrate on repairing the wing of my Beaver, which is of stick construction. The techniques I'll use are applicable to all built-up construction.

REPAIRING THE WING

There are two keys to the successful repair of a structure like a built-up wing:

- dimensional accuracy and alignment
- strength

When the covering and sheeting have been removed and the damaged areas identified, jig-up the wing on your building board so that it's straight and has the correct dimensions. Weight it down with bean bags or sand bags.

7. With the fuselage and the wing repaired, the Beaver is ready for covering.

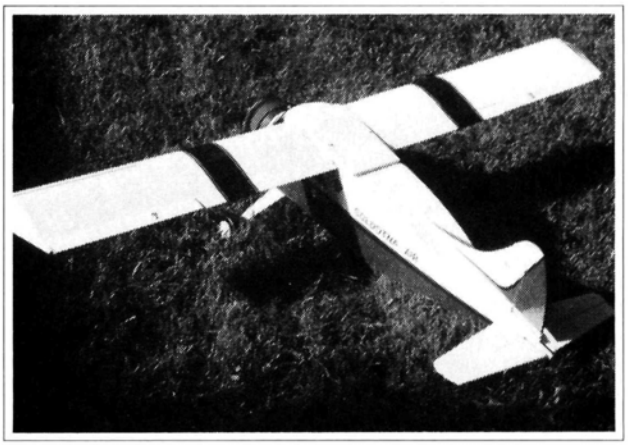
• **Splicing hints.** The trick to making strong and straight repairs to longerons, spars, and leading and trailing edges is to make good splices. For strength, a splice must be eight to ten times longer than the thickness of the material to be repaired. For 1/4-inch square stock, that means a splice that's at least 2 inches long. Decide on the length of the replacement piece, and then, to be safe, cut it a couple of inches longer. With your razor saw, make a splice cut on one end, remembering the length criteria mentioned.

Lay this new part on the old part, align it carefully, and then mark the required splice cut on the old member. Make that cut carefully with your saw. If it's done correctly, the result will be a good fit.

Now, make the splice cut on the new part at the other end. Clamp the first splice joint, and mark your cut on the old member for the second cut. When the four splice cuts have been made (both ends), clamp both joints and apply thin CA. The result will be a joint that's as strong and as straight as the original. Repeat until all the members have been repaired.

• **Repairing ribs.** Use the broken ribs as templates to cut new ones, which can either be doubled over the old ones or slipped in as replacements.

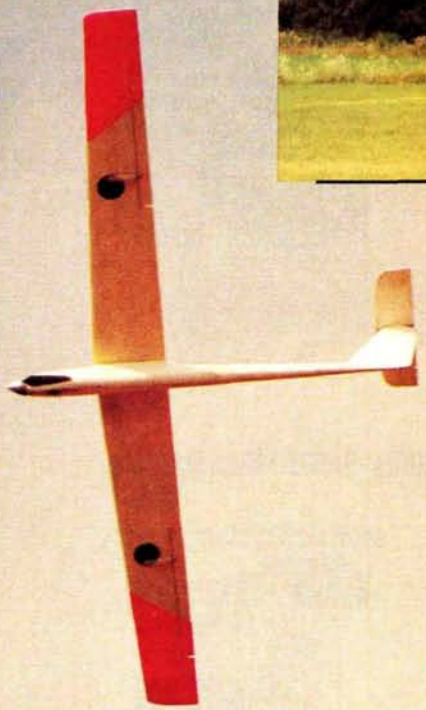
In a surprisingly short time, you'll have your "crash" ready for covering. You'll amaze people at the flying field with your completely rebuilt plane. So, next time you crash, stay away from that trash can! ■



8. Anyone for flying?

WORLD F3E CHAMPIONSHIPS

by DAVID MARTIN



■ *Top: Jerry Bridgeman launches for Steve Neu.*

■ *Above: A U.S. F3E plane in flight.*

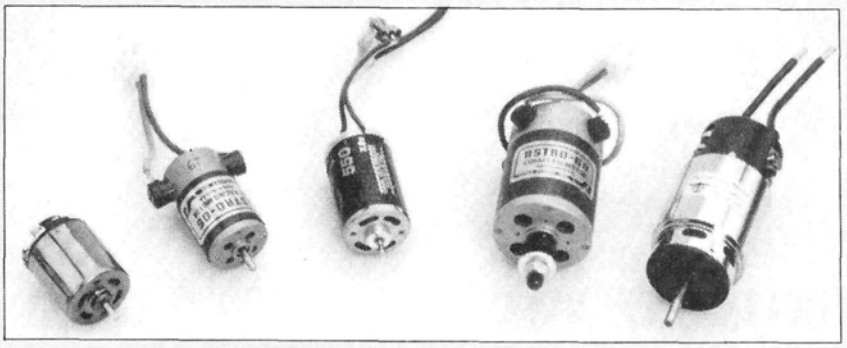
■ *Far left: Jason Perrin of the U.S. team took 2nd place overall.*

■ *Left: Rudolf Freudenthaler, 1st-place winner of the F3E FAI competition.*

PHOTOS BY DAVID MARTIN

U.S. TAKES THE SILVER IN AN UNPRECEDENTED UPSET

THE AMAZING F3E ELECTRIC



Note the size of the motors used in F3E FAI compared with three popular hobby motors. From left to right: Mabuchi can motor (used primarily in R/C cars); Astro FAI 05 racing motor and Carl Goldberg Turbo 550 (both used in model electric planes); and the Astro 60 FAI F3E and Plettenberg HP 355/40 motors (used in F3E FAI).

FROM AUGUST 6 to 11 of 1990, the 3rd F3E R/C Electric World Championships was held in Freistadt, Austria. It was hosted by the Federal Division Model Aeronautics of Austria (Freistadt), the Austria Aeromodeling Club and the city of Freistadt. In addition to the official F3E FAI competition, associated programs were held on August 1 to August 5. These included open-class events of Dawn to Dusk, Pylon Racing (7 cells), Wide-Span Glider, Aerobatics and F3E FAI. The U.S. team traveled to Austria hoping to do well; but even they didn't believe they would capture 2nd place in the F3E-FAI World Championships!

Judges for this prestigious event included Cal Ettel (organizer of the St. Louis World Championship), Werner Groth (Germany) and Dr. Edwin Krill (Austria). Between them, they had well over 100 years of modeling experience!

Freistadt is located about 25 miles north of Linz, the capital of Austria and 35 miles south of Budejovice, (pronounced "Budweis") Czechoslovakia, home of a famous beer! Temperatures at the municipal airport were in the upper 80s to low 90s during the competition.

F3E FAI

This consisted of distance and duration events, run consecutively. Eight rounds were flown, but the lowest score was thrown out (see sidebar, "Getting Involved"). At the end of a round, pilots had to land in a 15-meter circle, and several planes had a small spike on the bottom of the fuselage to help stop them.

FLYING IN COMPETITION

The airplane leaves the launcher's hand with a high-pitched scream, its motor initially drawing between 60 and 75 amps (more than 2,000 watts of output). The plane climbs almost vertically for 15 to 20 seconds to the left of base "A." (At the top of the climb-out, 1st-place winner Rudolf Freudenthaler's plane could only be seen after he had pushed its nose over for level

F3E is one of the most demanding model flying events. A typical F3E high-speed sailplane has a 2.1-meter (82-inch) wingspan, weighs around 92 ounces, can climb to 900 feet in 15 seconds and is capable of flight speeds of well over 100mph. The ships competing at the '90 championship exemplify the latest in F3E design.

These airplanes have no rudder; they fly with motor, elevator and aileron control. Air scoops aren't used because they cause wind resistance. The F3E sailplane must be light and strong, and able to pull high Gs and fly fast to maximize laps in the distance task. It must also thermal well for minimal motor run time in the duration task.

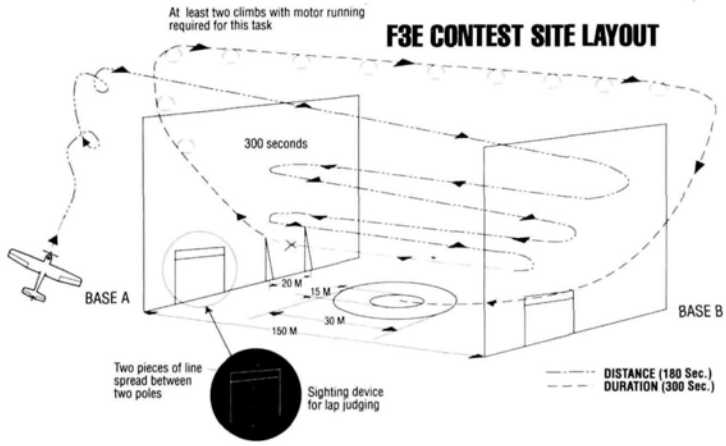
Freudenthaler's F3E. Note the discharge resistor, 27-cell packs, Sommerauer 75-amp speed controller.

Top-performing F3E planes are typically made of fiberglass, Kevlar, epoxy/composite materials and are reinforced with carbon fiber. The F3E sailplane uses the strongest electric motors available and is powered by 27 SCR, 900mAh, Ni-Cd cells. No conventional model airplane—gas or electric—climbs out like an F3E plane.

The U.S. team took a strong 2nd place using the FAI Astro 60 with Astro's new 205 speed controller. The U.S. planes seemed to climb as well as, or better than, any of the competing ships. Stator rings, which focus the magnetic field for increased efficiency, torque and duration (at a slight weight and rpm sacrifice) were used on the motors. Airtronics Vision radios controlled the U.S. planes.

The most popular equipment used by other teams included the German Plettenberg no. 355/40 6-turn motor (with neodyn magnets), the Swiss Sommerauer 75amp speed controller and the German Graupner MC-18 radio.

The highest-performing aircraft and propellers are handmade. Propellers are 12x8 folding props. Generally, the U.S. team used smaller props that turned at slightly higher rpm than those used by the competitors. The only commercial folding props used at the meet were handmade by Freudenthaler.



GETTING INVOLVED IN FAI/F3E COMPETITION

by JOE BESHAR, Chairman, AMA F3E Team Selection Committee

■ **THE CHALLENGE.** F3E competition consists of a distance task, a duration task (with no landing between the two), and a final precision landing inside a target of two 15- and 30-meter concentric circles. Landing in the 15-meter circle earns 30 points and in the 30-meter circle, 15 points. The course is set up between two imaginary vertical planes that are 150 meters apart (see diagram). These planes are defined as "Base Line A" and "Base Line B,"and "A" has a gate that's 20 meters wide and only 3 meters high.

■ **THE DISTANCE EVENT.** In only 3 minutes, you must do the following, with at least two powered climb-outs: fly as many 150-meter laps as possible (each counts for 15 points) and finish by flying through the gate to complete the distance task—the first half of your run.

■ **THE DURATION EVENT.** Without landing, *fly* for 5 minutes and finish by landing on a target. You can turn the motor on and off as you like, but note the motor run time is deducted from your flight time. Each second of gliding counts for 1 point. If you want to be a real winner, zoom through the gate at the end of the distance task, climb to altitude without any motor run, and thermal with a goal of landing in 5 minutes, inside the target, for a maximum score of 300 points. If you fly for more than 3 minutes, you lose 1 point for every second. Not really bad, is it?—but challenging.

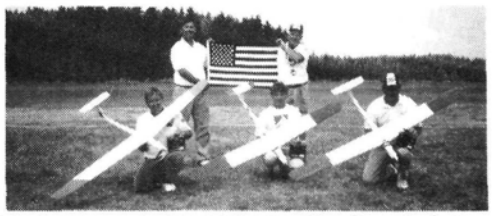
IF YOU WANT TO COMPETE

The U.S. Team Selection Committee approved a permanent program for F3E starting in 1991, and copies are available from the AMA. For the next World Championships in 1992, team selection will be accomplished through Qualifying and Fly Off. Candidates must pay a registration fee and have both an AMA and NAA membership with a current FAI stamp.

■ **QUALIFY** by placing at least third in an AMA-sanctioned F3E contest with at least eight competitors, or by achieving a score of at least 500 points at a local meet, while flying in strict accordance with the FAI Sporting Code and witnessed by an AMA contest director. You must qualify by the last day of the 1991 NATS.

■ **TEAM SELECTIONS FINALS** will be held between August and October, 1991, for the 1992 World Championships, which will probably be held in August, 1992 (to be announced). The team will consist of the three top finishers in the finals with the fourth-place finisher as an alternate. F3E competition is challenging and uses the latest in advanced electric-flight technology. If you're excited about participating, why not give it a try?

flight.) The pilot climbs to the left of base "A" so that he has time to roll to the right, accelerate and turn off the motor before starting the first lap. The rules require a minimum of two climbs, but three climbs were performed. A good flight would have an eight-lap average for each climb.



The U.S. Team (left to right): Steve Neu (kneeling), Jason Perrin and Jerry Bridgeman. Helper Brian Chan and Team Manager Bob Sliff stand behind. (Photo by Bob Sliff.)

THE U.S. TEAM

The U.S. Team included Steve Neu (San Diego, CA), Jerry Bridgeman (Huntington Beach, CA) and Jason Perrin (Newport Beach, CA); their manager was Bob Sliff (owner of Hobby Horn); and team support was given by Brian Chan (Hillsborough, CA), Keith Finkenbiner (San Diego, CA), and Grant and Lynn Messinger (FL).

Had there been an award for "Most Improved," the U.S. team would have won. This time, they had better equipment, including state-of-the-art cobalt 60 racing motors and new Astro Flight speed controllers. They also had hundreds of cells graded before they chose the best for the highest performance—matched packs.

How did they fare? The U.S. Team took silver medals in both the Individual and Team Classes. Jason Perrin put on a very strong showing and closely chased the champion, Freudenthaler, for 2nd place. Jerry Bridgeman and Steve Neu finished 8th and 9th, respectively, and this helped give the U.S. team the edge over the Germans and the Swiss.

To know when the motors were turned on and off, the judges listened for the click of the modified transmitter throttle switch on the Airtronic Vision radios used. On one lap, Neu's throttle switch clicked before his motor came on, and he was penalized for turning it on too soon. (An appeal based on a video tape was denied.)

I asked Team Manager Bob Sliff what was the most difficult part of his job. He said, "Not flying; keeping up with the schedule and all the changes to it; the German/Austrian lan-

guages and feeding a hungry team." The schedule was often changed and much was said only in German. The team agreed he was a good manager, but said "He didn't rent a nice Mercedes Benz to drive!"

■ *Left: The Graupner Discus was one of the planes used in the Wide-Span Glider event. Left to right: Konrad Neu, Mr. Graupner and Rudolph Freudenthaler.*

■ *Bad luck for the Italian team.*

DAWN TO DUSK

In this event, each team had to keep at least one airplane flying from the official sunrise to the official sunset, and the team with the fewest launches would win. Airplanes were only allowed to carry up to 1.1 kilo (2.4 pounds) of Ni-Cds. The most competitive designs were ultralight with ultra-low current draw (some offered up to 40 minutes of motor "on" time!). The Swiss took 1st place (11 flights; longest flight by Jean-Pierre Schiltknecht, 2:51:47) and the Germans 2nd (12 flights; longest by Wolfgäng Schaper, 2:29:12).

Schiltknecht's airplane (his own design) weighed only 40.5 ounces, used 12, 1700mAh, SCE Ni-Cds, a 20W Maxon Swiss motor with 6:1 Marx pile gearbox, and a Graupner MC-18 radio system. A second group fell into the "survivors" category. They just wanted to keep an airplane in the air all day, have fun and avoid sunburn or dehydration, because that would ruin the beer-drinking activity later. The most popular airplane was the Graupner Electro Junior, which used a Speed 600 8.4V motor and an 8x4.5 Scimitar folding prop.

F3E WORLD CHAMPIONSHIPS

Individual Results		Team Results	
1 Rudolf Freudenthaler	Austria	1	Austria
2 Jason Perrin	USA	2	USA
3 Franz Weissgerber	Germany	3	Germany
4 Urs Leodolter	Switzerland	4	Switzerland
5 Jean-Pierre Schiltknecht	Switzerland	5	France
6 Michael Gerringer	Austria	6	Belgium
7 Helmut Kirsch	Austria	7	Italy
8 Jerry Bridgeman	USA	8	Australia
9 Steve Neu	USA	9	Netherlands
10 Alfred Hitzler	Germany	10	Sweden

WIDE-SPAN GLIDER EVENT

Although flown on a hot, sunny, breezy day, the high-performance sailplanes (wingspans of over 3.78 meter) flown in this event weren't bothered much by wind. The object was to fly for exactly 10 minutes and then spot-land with no more than 60 seconds motor run time.

Brian Chan (U.S.) holds a small Race Rat of the type used in the pylon event.

Germany's Volker Keck took 1st place with his Robbe ASW 17, which used a Keller 100.6 motor, a Freudenthaler prop and 20 SCR, 1200mAh cells. Austria's Freudenthaler took 2nd flying a Graupner Discus powered by an Ultra 2000 motor, a Freudenthaler 12½x6½ prop and 24 SCR, 1200mAh cells. Schiltknecht of Switzerland took 3rd, flying his own design with a geared motor.

PYLON RACING (7 CELLS)

In this, a pylon-course lap measures 400 meters, and the fastest 10 laps wins. These planes' fuselages were generally of fiberglass, and their wings were balsa—both with carbon-fiber reinforcement. Werner Dettweiler had won the Pylon Race in St. Louis and was viewed as "the person to beat," but after breaking his prop on the first round and some lap-counting confusion that caused him to repeat the second round and fly the third immediately, he took only 2nd place. He used a Plettenberg HP270 4-turn motor and a Graupner 6x6 prop carved to higher pitch, and he did win the "4-minute" pylon race.

AEROBATICS

The most popular airplane flown was a Freudenthaler design—the Acrobat. The average wingspan of aerobatics airplanes was 1,700mm (67 inches), they weighed about 6 pounds, and they used 21 to 24, 1200mAh, SCR cells. Standard airplane propellers were typically used, the most popular being the Graupner 10x8-inch pattern prop. The typical motor was the Keller 80-8 or the Ultra 1800.

CONCLUSION

In 1990, the American team went to play an international game on foreign soil. They had top equipment, but, most important, they had studied, built and practiced. To their great credit, they came home with 2nd-place honors—an upset to some! ■

ENGINE EVALUATION

SHURIKEN .050 AND .061

by MIKE BILLINTON

Both Shuriken engines are anodized red. The larger engine (right) is the rear-exhaust version. Each engine can be converted to either of the two capacities by interchanging the liner and piston.

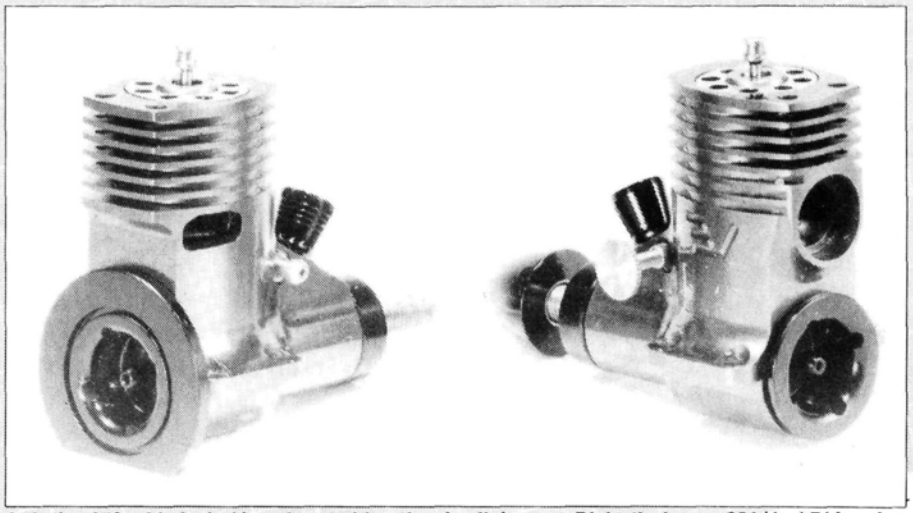
WITH ITS SIGNIFICANTLY greater rpm potential, the small Shuriken 2-stroke engine makes current standards for racing-engine performance seem out-of-date. Available in 0.050, 1/2A size (for high-speed C/L, and combat and pylon R/C) and in 0.061 size (experimental free-flight class F1J), these engines will be essential for aspiring competitors.

The idea behind the Shuriken isn't new. Its standard one-piece crankcase, Schnuerle/ABC liner, piston and front-induction system owe much to the best of the fearsome 3 1/2cc car engines and the earlier Rossi 2 1/2cc FAI International Class motor. So what makes it great?—its smallness and necessarily precise construction *combined* with these design virtues. These are what set it apart from its nearest rivals—the fabled Cox 2-strokes. The Cox engines rotate at "fiendish" rpm, but their radial porting restricts gas flow at very high rpm, and the ball-and-socket method of attaching the piston to the little end of the connecting rod mechanically curbs upper rpm levels.

SUPERLATIVE SHURIKEN

The new Shuriken design addresses these limitations and shows considerable improvements in material technology that exploit the advantage of smallness—significant horsepower at phenomenal rpm.

In theory, all engines should be able to benefit from the rotation part of the "torque x rpm = hp"



Left: the .050 cubic-inch side-exhaust with optional radial mount. Right: the larger .061 (1cc) F1J engine with optional needle valve. Note the turned rings on the outside of the venturi; they denote size.

formula. In practice, the high inertia of their larger reciprocating parts and the lesser hindrance of limiting flame speed over large-bore diameters inevitably restrict larger engines. It has always been a matter of big engines being unable to reach high rpm rather than small ones being able to. This area has been waiting for very small engines to exploit, and the new Shuriken engines do just that.

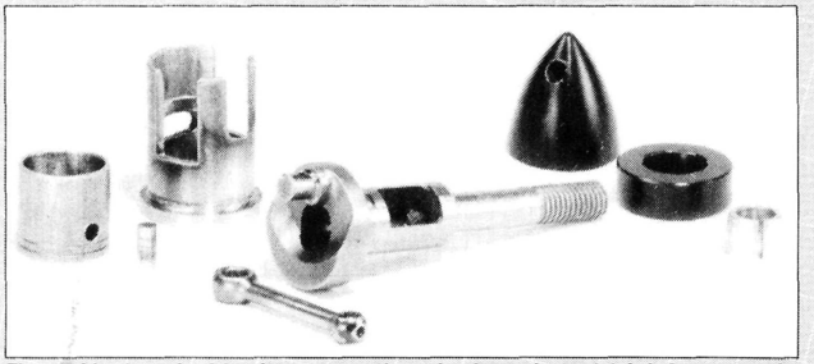
It's possible that larger racing engines will soon be in the works; a .40 that's able to reach 3hp at near to 27,000rpm is envisioned. Shuriken designer Fred Baldwin (who has Indy car engine experience) claims to be apprehensive in the presence of his .061 on tuned pipe showing 45,000rpm and a probable .5hp. What will he feel like when the .40 fires up! Is this what we've come to?—a 1cc motor that can make a grown man flinch!

47,000 RPM!

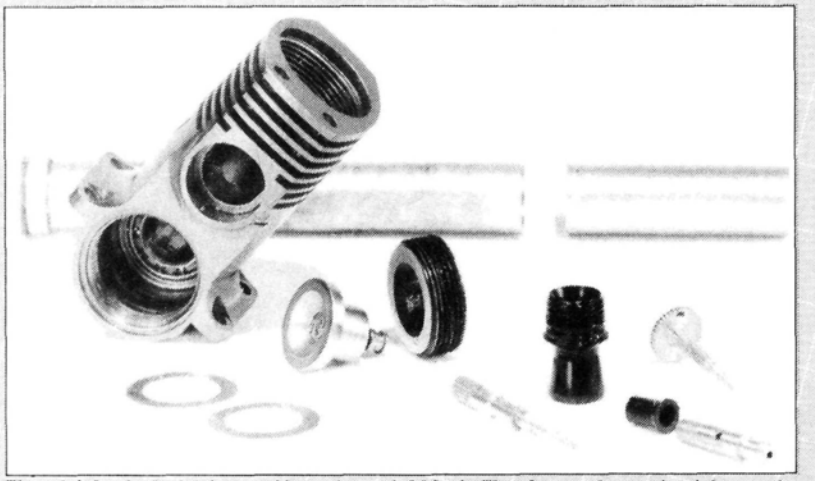
The arrival of these high-tech 1/2A motors is probably connected with the need of the International FAI Class to consider changing the long-standing 2 1/2cc capacity limit in certain model categories. Remember that the FAI reduced the early 10cc limit to 5cc and then to 2 1/2cc. There would be nothing unusual about decreasing capacity further to prevent performance from ballooning out of sight. Some of you might ask: "Will a finger still fit into the bore?!" The 15mm bore of the 2 1/2cc engine just allowed it; at 11mm, the Shuriken's bore does *not!*

In designing the Shuriken, Fred Baldwin and Jim Van Arsdall (the "B" and "V" of BV Competition Engines) have drawn on their knowledge of Cox 1/2A engines, the experience of many committed competitors (e.g., Dale Kirn, Warren Kurth, Harry Roe) and the lessons learned from the famous Indy Offenhauser straight-4 engine. They've produced an engine that combines extreme rigidity with very light reciprocating parts—essential bases for very high rpm.

The Shurikens' metallurgy has benefited from the pair's Indy car engine operations; the same very high-grade metal is used. Compared with competitors, the Shurikens' tensile strength is greater: in fact, the wristpin, connecting rod and crankshaft are all three times stronger! The bar-stock aluminum-alloy case is approximately twice as strong as the usual die-cast product, and the piston is forged of high-silicon bar-stock. The ABEC Grade 7 ball races used are also very significant in the production of high rpm. This is probably the first time that such extremely precise races have been used in the commercial production of a model airplane engine.



The combined weight of the piston, connecting rod and very short wristpin is 2 grams, so the crankshaft needs very little "overbalance," and the engine can reach high rpm. Note the fully extended transfer and boost ports that serve as the transfer passages. The relieved bore below the exhaust port is visible.



The minipipe in the background has a bore of .36 inch. The pipe section on the right was the part cut off to obtain the best resonance point during the last test run. The case was finely machined out of solid bar-stock on CNC equipment; the fit of all the parts and threads is very accurate.

The bottom line with all this high-tech stuff is that it leads to reliable, continuous operation at very high rpm. If this technology is modified for larger model engines, then BV's hopes for "the new racing engines of the '90s" will probably be realized. In the short run, dB levels could be a problem (until a suitable muffler/tuned pipe is available). Of course, BV might coax ever higher rpm from their engines—to sound levels above those audible to humans!

MECHANICAL POINTS

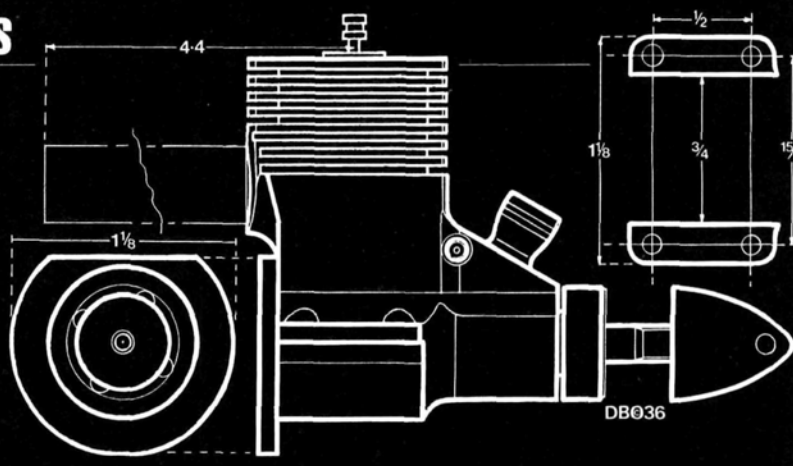
It's interesting that the CNC-milled, one-piece, bar-stock crankcase has no transfer passages. This case is so solid that it's indestructible. Parts fit and are secured with screw threads (i.e., rear cover, carburetor and cylinder-head clamp ring); and the 5/16-inch stainless-steel rear main bearing has 11 balls and a plastic high-speed cage; the front bearing has eight balls.

The one-piece, alloyed-steel crankshaft is balanced for 40,000rpm, and the crankpin has been drilled to allow oil to reach the rod's big end. The shaft has been treated with nitride to obtain the best hardness/toughness ratio. The connecting-rod is of high-alloy steel that's slightly less hard than the surface of the crank-

SHURIKEN .050 AND .061

SPECIFICATIONS

Shuriken 0.50 side-exhaust
& 0.061 rear-exhaust
(0.061 figures in parentheses)



ACTUAL SIZE

Capacity	0.050 cu. in. - 0.8196cc (0.0611 cu. in. - 1.001cc)
Bore	0.399 inch - 10.13mm (0.441 inch - 11.2mm)
Stroke	0.400 inch - 10.16mm
Stroke/bore ratio	1.002:1 (0.907:1)
Timing periods	Exhaust - 150° Transfer - 120° Boost - 120° Front Induction: —Opens - 35° ABDC —Closes - 65° ATDC Total Period - 210° Blow-down - 15°
Combustion volume	0.126cc (0.132cc)
Compression ratios	Geometric 7.5:1 (8.58:1) Effective 5.5:1 (6.31:1)
Exhaust-port height	0.120 inch - 3.06mm
Cylinder-head squish	0.013 inch - 0.33mm
Cylinder-head squish angle	Curved; hemi-head
Squish-band width	0.025 inch (0.045 inch)
Carburetor bore	0 .150 inch - 3.8mm (0.180 inch - 4.57mm)
Crankshaft diameter	0.312 inch - 7.94mm
Crankshaft bore	0.225 inch - 5.73mm
Crankpin diameter	0.125 inch - 3.18mm
Crankshaft nose thread	0.186x32 inch TPI - 3/16 B.S.F. - 2BA - ANF 10-32
Wristpin diameter	0.094 inch - 2.39mm
Connecting-rod shank	0.094 inch - 2.39mm
Connecting-rod centers	0.8 inch - 20.32mm
Engine height	1.797 inches - 45.66mm
Width	1.128 inches - 28.67mm
Length	1.79 inches - 45.5mm
Width between bearers	0.750 inch - 19.22mm
Mounting-hole dimensions	0.9375 inch x .496 inch - 23.3mm x 12.62mm
Weight (bare)	2.25 ounces - 64 grams (2.2 ounces - 63 grams)
Crankshaft weight	0 .35 ounce - 11 grams
Piston weight	0.04 ounce - approx. 1 gram
Connecting-rod weight	0.04 ounce - approx. 1 gram

pin bearing. To reduce weight, some rods have been drilled right through their shanks, which are only 3/32 inch in diameter to start with!

The chromed-brass cylinder liner has Schnuerle porting, which is usual in much larger engines but unusual in this size. (The Chinese CS engine is an exception.) The three inlet ports (one exhaust, two side transfers and a single boost—angled up 70 degrees) are unusual in that they extend right down into the crankcase, so they assume the function of transfer passages. Their volume varies with liner thickness; the bored-out passages of the .060 engine have thinner liner walls and smaller volume, so higher velocity. The cylinder bore under the exhaust port is relieved, so for guidance, the piston relies on four narrow liner strips below port level. This must surely reduce overall piston friction.

Weighing approximately 1 gram, the aluminum-alloy (17 percent silicon) piston has a high-set piston pin of top-quality alloyed steel. The manufacturers' concern with reciprocating weight is evident here because the pin's diameter is only 60 percent that of the piston. Clearly, more support in piston bosses could be obtained by lengthening the pin, but this would reduce rpm potential (all is compromise!). Conveniently, the piston-pin material is used for the twin pins of the universal locking wrench that's used for the cylinder head and backplate. One piston boss has been machined part of the way through, and a tiny circlip secures the pin at other side.

The cylinder head is essentially a proprietary Glo-Bee R5X button that's held in the case and on the liner by a clamping ring. The combustion chamber has a "shallow hemi" shape and a very narrow squish band.

Open-throat venturi carburetors are available in several (marked) bore sizes ranging from 0.125 inch to 0.180 inch. At the moment, there's no throttle for R/C use, so slow rpm can only be achieved with rich fuel settings, which won't get you much below 12,000rpm (though that's some relief from 30,000rpm).

There's talk about introducing an exhaust throttle soon. To remove the venturi, grip its "waist" with a round-nose pliers sleeved with silicone tubing. The Kirn-type fuel jet is a firm "push-fit" into the crankcase and can be tapped through from

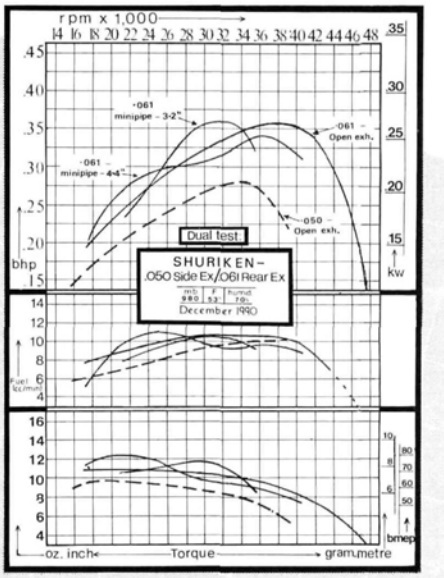
Performance:

Max. b.hp ..... 0.36 @ 36,624rpm (0.061 - open exhaust/50% nitro)
0.28 @ 34,424rpm (0.050 - open exhaust/50% nitro)

Max. torque ..... 12.5 oz/ins @ 20,732rpm (0.061 minipipe/50% nitro)
9.2 oz/ins @ 17,500rpm (0.050 open exhaust/50% nitro)

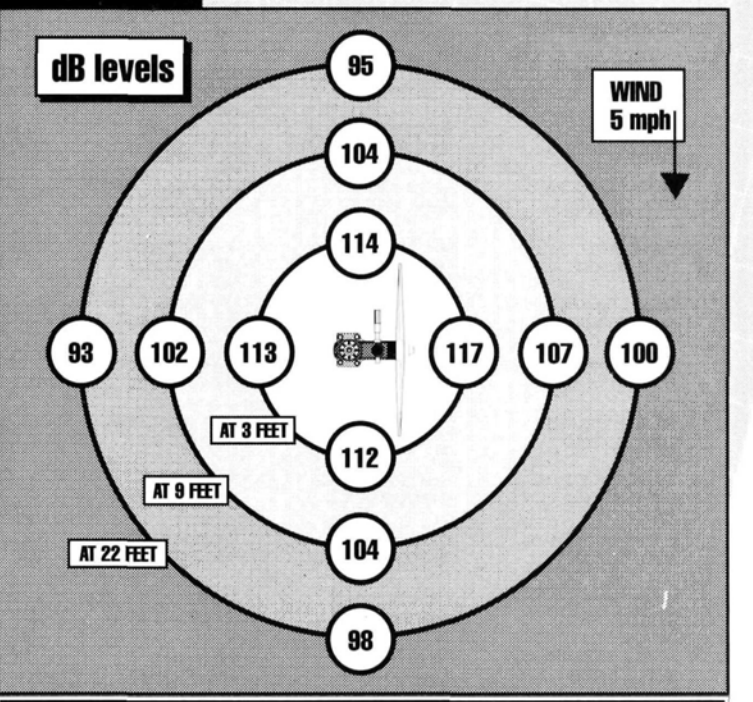
RPM on standard propellers:

	0.050 (open ex.)	0.061 (open ex.)	0.061 (std. m/pipe)	0.061 (m/pipe—3.2ins.)
6x3 Master	18,050	—	—	—
5½x4 Cox (wide bl. gray)	—	20,000	20,909	—
5x4 Tornado (black)	22,750	24,990	25,150	—
5½x3 Tornado (black)	23,935	25,820	26,000	26,920
5x4½ Top Flite (wood)	27,992	29,550	29,025	—
3¾x4½ Top Flite (cut-down)	—	35,930	34,600	37,136



Performance Equivalents:	0.050	0.061
b.hp/cubic inch	5.6	5.89
b.hp/cc	0.34	0.36
Ounce inch/cubic inch	184.0	204.6
Ounce inch/cc	11.22	12.48
Ounce inch/pound	65.40	90.91
Gram meter/cc	6.48	8.79
b.hp/pound	1.99	2.62
b.hp/kilo	4.37	5.71
b.hp/square inch frontal area	0.218	0.28

Manufacturer/Distributor: BV Competition Engines, 1205 Country Club Rd., Indianapolis, IN 46234.



SOUND LEVELS—dB

Engine: ..... Shuriken .061 (rear exhaust)
Equipment: ..... Open exhaust
Fuel: ..... 50% nitro/15% ML70/35% methanol
Temperature: ..... 51°F
Humidity: 70%
Propeller: ..... 5½x3 Tornado
Mean rpm: 25,400
Engine position: ..... 3 feet above the ground
Sound meter: ..... Radio Shack's 33-2050 unit set 38 inches above the ground and pointing toward the nearest sound (propeller or muffler outlet) at distances of 3 feet, 9 feet and approximately 22 feet.
Meter settings: ..... "A" scale and "slow" response

the needle side (use the Kirn needle almost screwed home).

SMALL-ENGINE HEAT

Heat loss in very small engines is notorious, and it gives them the ability (need, even) to use very high-nitro fuels. The Shuriken's solidity and large heat-sink capacity cause markedly cool running, so measures like relieving the liner's exterior to inhibit heat transfer to the case are now occasionally being resorted to. This is done just to get the brass liner to heat up and expand away from the quickly expanding piston.

Alternatives also being tried are ceramic-coated aluminum liners that should move more quickly in the first place. As Fred Baldwin comments, "The starting point is the piston. High-silicon content certainly reduces expansion, but it's too brittle for really high rpm. Maybe it's best to back off on the silicon and deal with...higher expansion problems in other ways."

(Continued on page 89)

SPORTY SCALE

(Continued from page 21)

UNLIMITED TIMES TWO

From what I understand, the Unlimited* race for scale models of Reno racing aircraft is all but official. If everything goes well, in next month's issue, I'll be able to give you the exact dates and location. I really hope this one comes off; it will do a great deal for model aviation on the whole and for scale modeling in particular. For those who haven't heard about it, this is a race for scale aircraft of Unlimited Class Reno racers only. The model must have flown at Reno, but it may be entered in any color scheme. The rules are simple: 100-inch wingspan, AMA 55-pound weight limit; outlines must be 95-percent to scale; and you must *go fast!* More next month.

Another form of Unlimited competition will probably cause some controversy. You've all read or heard the nonsense in other publications about throwing away the "builder of the model" rule in scale competition and allowing a participant to enter a model built by someone else. Obviously, real competitors don't want any part of this. They feel that building their entries is part of the competition, and I totally agree.

We'll find out whether scale modeling will benefit from dropping the "builder" rule, because the Top Gun board of directors has voted to allow six manufacturers to enter the Unlimited Cup in next year's Top Gun Invitational. That's right; in 1992, if you have a recognized sponsor from the hobby industry, you may apply for an invitation. It doesn't matter who builds the plane, who paints it, who gears it up, or who flies it. You can buy the whole plane or just parts, and you'll compete against five others under the same rules as the rest of the Top Gun pilots. There will be just one award for the winner—no glory for finishing 2nd, but lots of recognition and glory for placing 1st! Now, let's just sit back and see how many inquiries I get. I'll publish all requests as I get them.

That's it for now, scale fans. To those of you who have been writing or calling me about the "new scale magazine," I just want to inform you that you must write to our editor, not me. I'll tell you, however, that three letters just ain't gonna do it! We have to show our numbers, or we won't see anything happen for some time.

Next month, I'll share a new gripe of the month that's unfolding. Until then,

(Continued on page 88)

SPORTY SCALE

(Continued from page 86)

remember that there really isn't any tooth fairy, and don't forget to check that six!

**Here are the addresses that are pertinent to this article:*
Dave Spencer, *819 Corn Tassel Trail, Martinsville, VA 27412.*
Unlimited Racing, *565 Mercury Ln., Brea, CA 92621.*
Aeroloft Designs, *8716 South Roberts Rd., #A, Hickory Hills, IL 60457.* ■

VICTOR HI-IQ

(Continued from page 62)

A pack is supposedly only as good as its worst cell, so we should try to reduce the mAh capacity spread between the best and the worst ones. On a list showing each cell's capacity, I wrote the mAh spread for the unmatched and the matched packs. After matching, the mAh spread of the newly made 7-cell packs was approximately half that of the unmatched packs. The matched packs hold a more consistent power output through their discharge cycle, and this gives greater power throughout their run time. They also tend to fall off more in unison at the end of a run because they all hit the "knee" on the discharge curve at about the same time.

When rating the "seconds of discharge time," I also saw an improvement. When I compared the discharge times of the worst cells in unmatched and matched packs, I saw that five out of seven packs showed an increase in run time. From the best pack to the worst, the increase in discharge time in seconds was (unmatched pack/matched and graded pack): 397/401, 388/388, 319/329, 311/321, 289/315, 273/305 and 264/264. This shows that, through matching, run time should improve on all but two of the packs, and even these two will perform better overall because of the reduction of the mAh spread between the individual cells. Then, as the cells are cycled, you can expect further improvements.

This is just one of the many features that make the HI-IQ worth having. Even if you don't have enough cells to grade and match, you'll find that the cycling and conditioning functions of the HI-IQ improve your battery packs. You'll be able to learn more about each pack, and this will allow you to match each one with its intended use and get the most out of your flight systems.

• **Motor break-in.** This feature uses a 4- to 6-cell Ni-Cd pack for power, and it breaks-in the motor by varying rpm. This is done in

VICTOR HI-IQ

a 3-minute cycle; two cycles are recommended, but more might be required for motors with hard brushes.

The HI-IQ is now as important to me as a good motor or a high-performance speed controller. I now have better battery packs and understand the capabilities of each one. I know that when I take to the air, my batteries are fully charged and ready to go and that each pack will deliver its full potential. I could probably write several more pages about the HI-IQ's functions and benefits, but the only way to appreciate its capabilities is to use it, learn from it and grow with it!

**Here's the address of the company featured in this article:*
***Victor Engineering,** 380 Camino de Estrella, Suite 170, San Clemente, CA 92672.* ■

ENGINE REVIEW

(Continued from page 85)

PERFORMANCE

My first experience with the Shuriken (using some typical free-flight propellers) was an eye-opener: it produced high rpm early on, with remarkably little fuss. I

(Continued on page 91)

ENGINE REVIEW

(Continued from page 89)

eventually had to add a little amyl acetate (2 percent) to the fuel for priming and starting. (This was probably connected with heat loss and the coolness of the test day.)

I thought the proximity of the needle valve to props doing 35,000rpm was hazardous, so for the main torque tests, I lengthened it with a piece of neoprene tube. I spent some time on setting up my small "1/4-scale" dyno, which hasn't seen much action recently because I've been testing medium and large model engines.

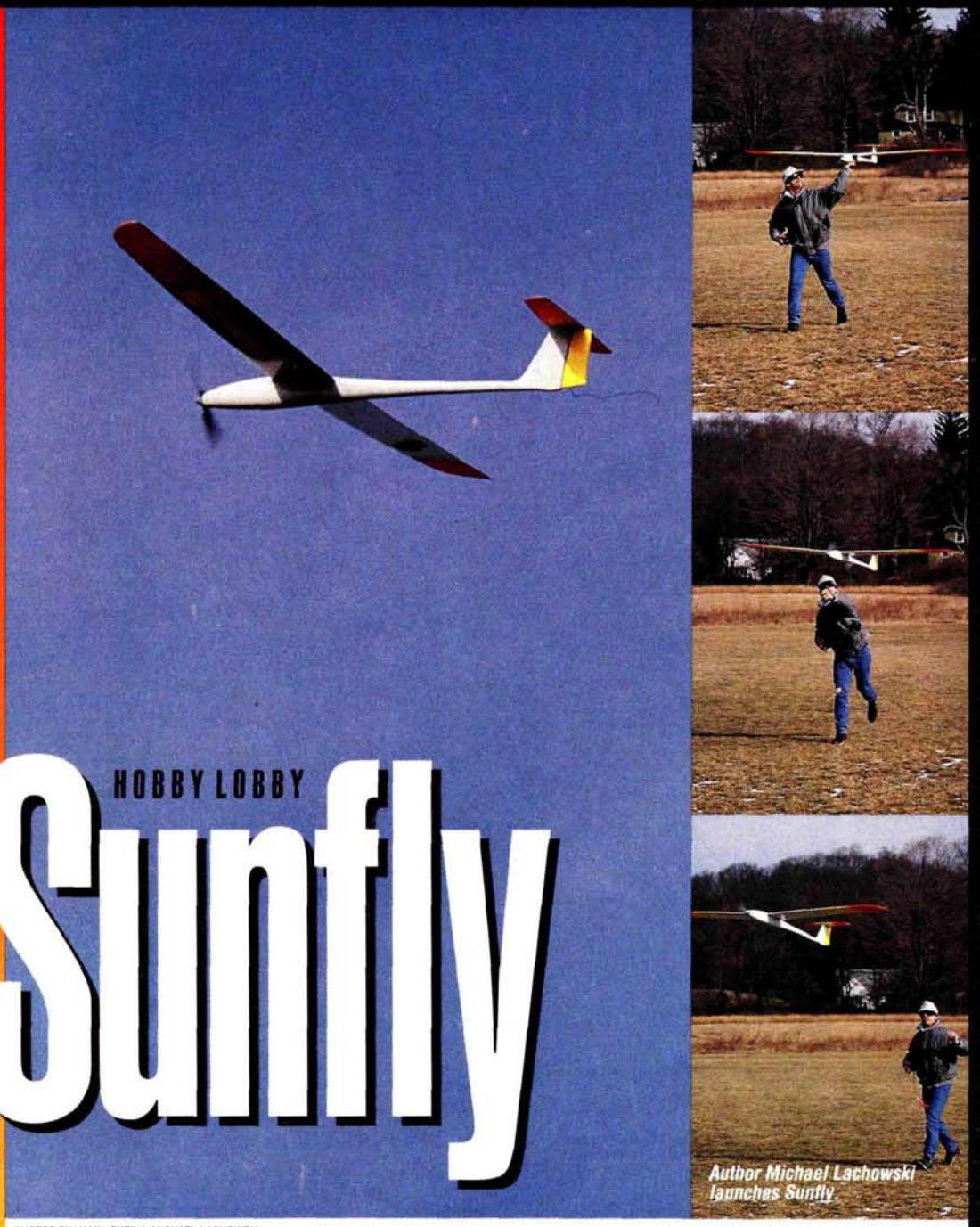
Test 1: 0.050 side-exhaust engine. Fuel: 50 percent nitro/20 percent ML70 synthetic oil/30 percent methanol. Venturi: 0.150

It's recommended that you use the USA's Klotz synthetic KL100 oil, which apparently contains a little castor oil, which, in large amounts, isn't easily miscible in fuels containing more than 40 percent or so nitromethane.

Because of the absence of recent test data on other engines, e.g., the Cox, it's difficult to compare their performance with that of the new Shuriken. (The last published results seem to be about 15 years old, or more.) It's noteworthy, however, that the Shuriken .061 (even without its tuned pipe, which wasn't available at time of test) is virtually on a par with the recently tested top-of-the-line O.S. .91 VR ducted-fan racing engine at 6 b.hp/cubic inch. I stress, though, that these

(Continued on page 113)

F3E-like soaring and aerobatic capability



Author Michael Lachowski launches Sunfly.

HOBBY LOBBY

Sunfly

PHOTOS BY YAMIL SUED & MICHAEL LACHOWSKI

by MICHAEL LACHOWSKI

HOBBY LOBBY* imports a variety of aircraft and electric equipment, including the Aeronaut Sunfly, which is an F3E-type sailplane and the only kit of this type that's reasonably priced. The Sunfly isn't a 7-cell model; it uses a larger 512W motor, and it has an 8-foot wingspan. Hobby Lobby describes the Sunfly as, "our first offering of the nearly ULTIMATE model airplane"—an impressive statement, and in reality, its performance is awesome.

The Sunfly can do more than just soar. In a dive, its speed is incredible. Some of my fellow club members just said, "Wow." There's more—how about some aerobatics? A roll on a high-aspect-ratio sailplane is graceful. With the Sunfly's clean airframe and substantial power, huge loops are possible.

KIT CONTENTS

Imported kits seem to come in nicer boxes, and there's always the challenge of converting metric units. Noted on the box are some of the awards won by F3E World Champion and designer of the Sunfly, Rudolf Freudenthaler.

For strength, the white, foam-core wings are pre-sheeted with a layer of fiberglass under the balsa sheeting. The balsa was of very good quality, and there was

The climb is super, and you'll probably never run the motor for more than 30 to 40 seconds, unless you have very good eyes.

only a slight bow on the trailing edge of one wing panel.

The well-made epoxy-glass fuselage has a white finish that's good enough to fly as is. Wing fairings formed from plastic sheet complete the fuselage.

I was disappointed with the solid balsa stabilizer. The kit includes a sheet that you have to carve to an airfoil shape. The kit should provide a sheeted foam stabilizer with a true airfoil shape. As luck would have it, the stabilizer tip blocks were missing from my kit, and one of the wing-tip balsa blocks was too heavy. Some of the punched plywood parts had to be cut with a saw because only the outlines had been pressed into the wood.

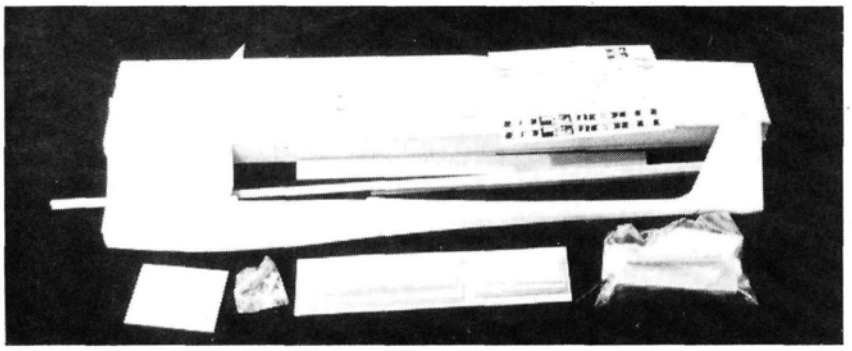
The complete hardware package includes pushrods, wing and stab bolts and a steel wing joiner. The plans include helpful cross-sectional views of several assemblies, control throws and equipment placement.

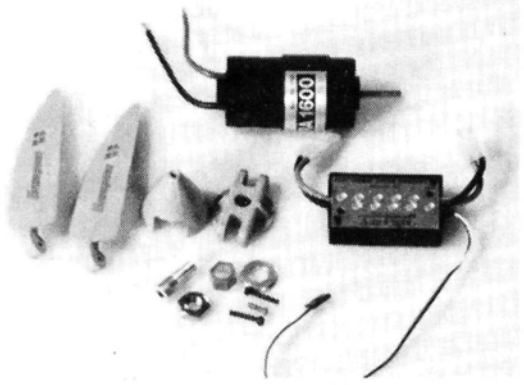
The four-page manual contains three pages of building instructions and one with a parts list. The text is a translation, and it's rough in places. Note the word "accumulators" just means batteries.

CONSTRUCTION AND ASSEMBLY

• **WING.** The factory has done much of the work on the wings. Besides wing sheeting, the aileron hinge line and servo locations in the wing were pre-cut. Servo wires must be run to the servo cavities along a wire channel that runs along the leading edge. Install the wires just before attaching the pre-shaped leading edge. Two balsa blocks provide the wing-tip shape, but I replaced one block on each wing tip with Rohacell*, and lined the edge of the wing tip with carbon fiber.

Although a steel wing joiner joins the wing for two-piece construction, I built the optional one-piece wing. The steel joiner is the dihedral brace, and layers of fiberglass cloth in the center further strengthen the wing. Plastic wing fairings are attached directly to the wing. Dowels in the front and

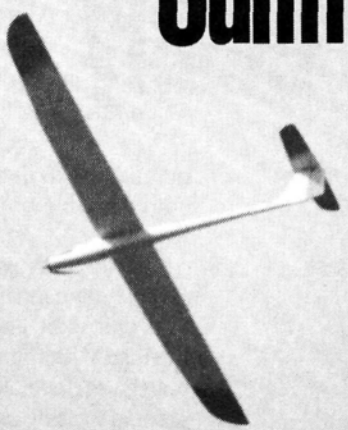




Above: This layout of the kit's parts shows that the Sunfly is mostly prefabricated. The kit includes a fiberglass fuselage and factory-sheeted, foam wing-cores.

Right: Power is provided by an Ultra 1600 direct-drive motor spinning an 11x7 prop. An Astro 205 speed controller, which includes a prop brake, was used in the author's model.

Sunfly



SPECIFICATIONS

Type: *F3E electric sailplane*
Wingspan: *95 inches*
Wing Area: *604 square inches*
Airfoil: *Eppler 387, thickness 9.06%, camber 3.80%*
Weight: *90 ounces*
Wing Loading: *21.5 ounces per square foot*
Length: *48 inches*
Power: *Hobby Lobby Ultra 1600 motor*
Prop used: *Hobby Lobby GPE11070 11x7 folding propeller, GPE10060 10x6 folding propeller*
Speed Controller: *AstroFlight Model 205*
Batteries used: *SR MAX-1000 , 14 cells*
No. of Channels Req'd: *5 (rudder, elevator, motor control,independent ailerons/ spoilers)*
Radio Used: *Airtronics Vision V8SP, RCD 7-channel FM receiver, two 94501 micro-servos, two 94401 miniservos.*
Retail Price: *Sunfly - $359, Ultra 1600 - $223, Astro Model 205 - $199*
Features: *Pre-sheeted foam-core wings, fiberglass fuselage, balsa empennage, complete hardware package, one- or two-piece wing and "T" tail.*
Comments: *A high-performance model for the experienced flier, the Sunfly really demonstrates the full capabilities of electric-powered aircraft. Give the sticks to some hotshot power flier who thinks electrics just wallow around the sky, and make sure there's plenty of altitude, in case he can't handle it.*

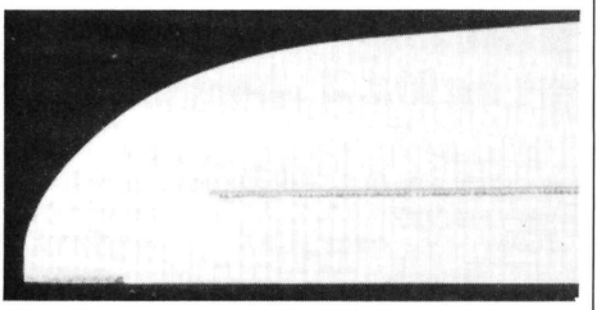
Sunfly

nylon bolts in the rear hold the wing onto the fuselage.

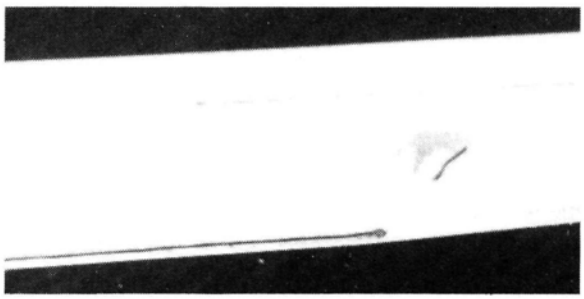
Use the thinnest servos you can find. My Airtronics* 501 servos fit flush with the wing's bottom surface. Nine-percent airfoils on narrow wing chords don't give you much room to work with. Plastic fairings taped to the wing protect the servo arm and reduce drag.

a very tight fit with this motor).

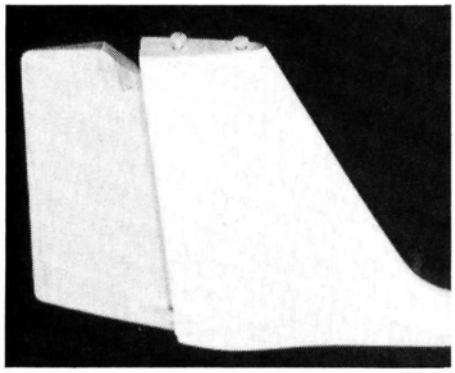
For the wing and tail attachment, I recommend that you replace the blind-nuts with threaded inserts. The inserts are easier to install, especially in the fin for bolting on the stabilizer. If you switch to U.S. threads, you won't have to search for extra 5mm and 3mm nylon bolts after a rough landing. Standard 10-32 and 8-32 nylon bolts are suitable substitutions.



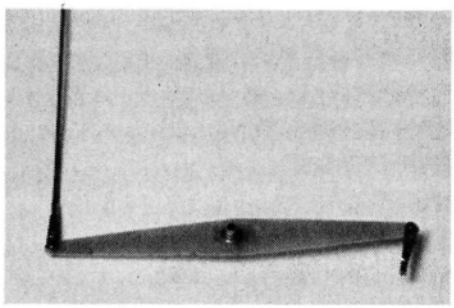
Aileron hinge cuts are made at the factory.

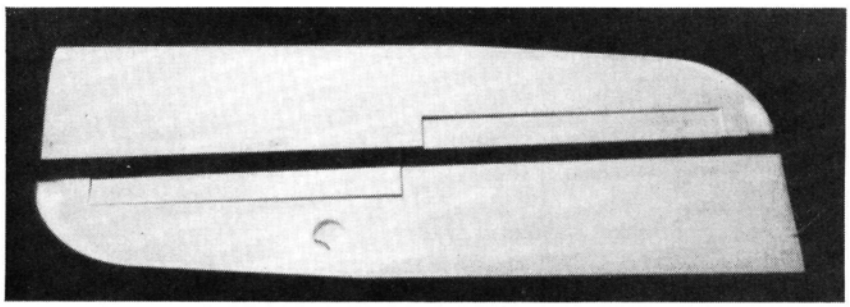


The servo extension runs behind the leading edge to the servo bay.



There's plenty of power—enough to pull the ship through very large consecutive loops. The glide is excellent but much faster than those of typical electrics or sailplanes.





Top left: A detail of the stab mounting bolt and rudder-horn fairing. The angle cut in the rudder is for the elevator control horn. Left: To minimize play in the elevator, the kit bellcrank was replaced with this custom-made ball-bearing bellcrank. Right: The assembled wing panels with completed tips and control surfaces.

• **FUSELAGE.** Fuselage construction is simple: just add the motor mount, the wing-bolt mount and the stab-bolt mount, and install the control system. A powerful motor like Hobby Lobby's Ultra 1600 requires the right thrust and downthrust shown on the plans (it's

The servo tray is mounted behind the wing under the rear access hatch. I use GE silicone RTV to attach the servo tray to the glass fuselage. The only remaining work is to fit the pushrods into the fuselage. The rudder control is a wire pushrod. A plastic pushrod guide glued to the fuselage aligns the pushrod with the fairing that's molded into the fuselage. (RTV works well here.) The elevator-control system has a balsa pushrod that connects to a bellcrank in the fin. This bellcrank transfers the motion to the top of the fin where a short pushrod transfers it to the elevator. Smooth operation and minimal slop are essential for good elevator centering.

• **EMPENNAGE.** The stabilizer is of solid balsa, so get out the razor plane and go to work. If you want a true airfoil, a NACA 0009 template will help. Don't worry about weight; the motor and batteries provide plenty of weight up front. To drive the elevator, I built a bellcrank using epoxy-glass plate and a ball bearing to minimize play in the elevator control. If you have trouble finding a bearing, search through the spares for R/C cars at your hobby shop for

something suitable. A fairing molded into the fuselage for the rudder control arm hides all control mechanisms.

• **COVERING AND FINISHING.** The fuselage doesn't need finishing! A little sanding and filling on the seam will do the job. I used Oracover* for the wing and tail covering. I first tried Fluorescent Yellow tips, which, I later found, disappear from sight quickly when you wear amber flying glasses. (The color stays visible if you wear grey-tinted lenses.) The aileron hinges are Oracover using the basket-weave hinging technique instead of the hinge tape supplied. The rudder hinges are EZ hinges.

• **MOTOR, BATTERIES AND SPEED CONTROLLER.** The Ultra 1600 motor is mounted to the plywood with three bolts. There's plenty of room for batteries; just make sure that they can handle the high current draw. SR* MAX 1000 batteries fit nicely in my Sunfly. Tell the people at SR that the current draw will be more than 30 amps so they should add extra insulators to the tabs that join the cells. The new AstroFlight* 205 speed controller provides throttle control—and excellent braking to ensure that the prop folds. Sermos Power Pole* connectors minimize power loss.

• **RADIO INSTALLATION.** A rear fuselage hatch provides access to the servos, which are behind the wing. To minimize drag, you can mount your receiver switch and charging jack inside the fuselage. It isn't obvious from the plans how the hatch works. From a closed position, the hatch slides rearward; to remove it, lift the front and slide it forward.

Although the Sunfly can be flown with a regular 4-channel radio, I installed the Vision computer radio to provide maximum flexibility in trimming and flight performance (see chart for recommended Vision settings).

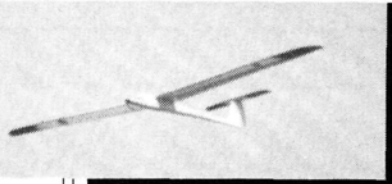
FLYING

Would you believe 70 degrees in New Jersey in the middle of November? The Sunfly was ready to go, and I was planning some weekend flying. Friday's weather looked great, but the weekend forecast looked horrible. I hurried out to the flying field to try the Sunfly.

With a short hand-launch, it flew straight and fast. I tried powered flight: the Sunfly climbed right out, but its nose kept going up. I needed some down trim to level out. The climb is super, and you'll probably never run the motor for more than 30 to 40 seconds, unless you have very good eyes.

Keep things moving; remember you're flying

(Continued on page 114)



Sunfly Vision 8SP Transmitter Settings

TRANSMITTER AND CONTROL TEMPLATE

MAIN MENU (1)	MAIN MENU (2)	
L Setup (ENT) (1)	L Setup (ENT) (2)	
Access Level 3	Access Level 3	
S Setup (ENT) (1)	**S Setup (ENT) (2)**	*Use 2 to store settings into setup 2 first time. Define alternate configuration switch here. Standard Mode II configuration.*
Alternate (2)	Alternate (OFF)	
Alter Mode? Yes	Alter Mode? Yes	
Mode B? No	Mode B? No	
Zero Sticks (ENT)	Zero Sticks (ENT)	
"EEP(ENT):0,21761"	"EEP(ENT):0,21762"	
BASIC CONFIG (1)	**BASIC CONFIG (2)**	
2A 1F E R (ENT)	2A 1F E R (ENT)	*Two aileron configuration, flap control is for the motor control.*
Gear Mode? Yes	Gear Mode? Yes	
V Tail? No	V Tail? No	
Slide Rev? Yes	Slide Rev? Yes	
Slide Spl? Yes	Slide Spl? Yes	
Freeze Flap? No	Freeze Flap? No	*No special flap mixing or high-rate mixing*
L Dsab Camb? No	L Dsab Camb? No	
La Hi A2R M? No	La Hi A2R M? No	
Lc Hi A2R M? No	Lc Hi A2R M? No	
Swp Ca<>A2R? No	Swp Ca<>A2R? No	
PPM 7	PPM 7	*For RCD 7-channel receiver*
Set L Thrsh (ENT)	Set L Thrsh (ENT)	
Reverse:YNNNYNNN	Reverse:YNNNYNNN	
1.32msS:NNNNNNNN	1.32msS:NNNNNNNN	

SURFACE ADJUSTMENTS, MAIN AND ALTERNATE

SURFACE ADJ (1)	SURFACE ADJ (@2)	
Center LAil: 0%	Center LAil: 0%	*Flip alternate set-up switch to view alternate settings. Note: centers will be adjusted according to your installation.*
Center Flap: 0%	Center Flap: 0%	
Center RAil: 0%	Center RAil: 0%	
Center Elev: 0%	Center Elev: 0%	
Center Rudd: 0%	Center Rudd: 0%	
Differ: 60%	Differ: 60%	
Land Differ: 60%	Land Differ: -90%	*Differential changes for crow aileron position. Note: adjust travels to meet surface movements on the plans.*
L Ail LTV: 80%L	Ail LTV: 80%	
L Ail RTV: 66%L	Ail RTV: 66%	
R Ail LTV: 66%	R Ail LTV: 66%	
R Ail RTV: 80%	R Ail RTV: 80%	
Flap TV: 66%	Flap TV: 66%	
Elev UTV: 90%	Elev UTV: 90%	*More up travel than down travel is required.*
Elev DTV: 50%	Elev DTV: 50%	
Rudder LTV: 66%	Rudder LTV: 66%	
Rudder RTV: 66%	Rudder RTV: 66%	
Side/Cmb TV: 0%	Side/Cmb TV: 0%	

MIXER ADJUSTMENTS, MAIN AND ALTERNATE

MIXER GAINS (1)	MIXER GAINS (@2)	
1 Ail->Rudd: 50%	1 Ail->Rudd: 50%	
2 Ail->Rudd: 25%	2 Ail->Rudd: 25%	*Normal flying with low rudder mixing rate.*
Rfx A->Rudd: 0%	Rfx A->Rudd: 0%	
Crow->LAil: 0%	Crow->LAil: 38%	*Crow is mixed in for alternate setup; raises both ailerons for landing control.*
Crow->RAil: 0%	Crow->RAil: 38%	
Camb->LAil: 0%	Camb->LAil: 0%	
Camb->Flap: 0%	Camb->Flap: 0%	
Camb->RAil: 0%	Camb->RAil: 0%	
DElev->Camb: 0%	DElev->Camb: 0%	
UElev->Camb: 0%	UElev->Camb: 0%	
Camb->Elev: 0%	Camb->Elev: 0%	
Spoil->Elev: 0%	Spoil->Elev: 0%	
Flap->Elev: 0%	Flap->Elev: 0%	
Gear->Elev: 0%	Gear->Elev: 0%	

PRESETS AND DUAL RATES, MAIN AND ALTERNATE

PRESETS/DR (1)	PRESETS/DR (@2)	
EPST #1: 5%	EPST #1: 5%	*Elevator can be preset for faster flying.*
EPST #2: 10%	EPST #2: 10%	
EPST Lch: 0%	EPST Lch: 0%	
EPST Rfx: 0%	EPST Rfx: 0%	
Camber Rfx: 0%	Camber Rfx: 0%	
Camber Lch: 0%	Camber Lch: 0%	
Flap Lch: 0%	Flap Lch: 0%	
Aileron D/R: 100%	Aileron D/R: 100%	*Consider adding dual rates to reduce control sensitivity in flight.*
Elev D/R: 100%	Elev D/R: 100%	

HELICOPTER SECTION

CONTENTS

In this issue: Aspiring R/C helicopter pilots who have yet to take the plunge: take a close look at Bill Griggs' article on Aerochopper flight simulation software. Appropriately, computer technology is now available to help us master flight skills in an equally high-tech hobby. For those who have ventured into the world of hovering and are looking to learn to loop, Craig Hath provides the recipe in this month's "Helicopter Challenge." Finally, Phil Noel offers some tips on using the High Point Balancer—make use of your mechanical skills and save money.

Photo above: AH-64 Apache ground-attack helicopter (anti-tank) pops over the horizon in a menacing fashion. Photo by McDonnell Douglas Helicopter Co.(manufacturer).

Helicopter Challenge

LOOPS—EASY, BUT CHALLENGING!

by CRAIG HATH

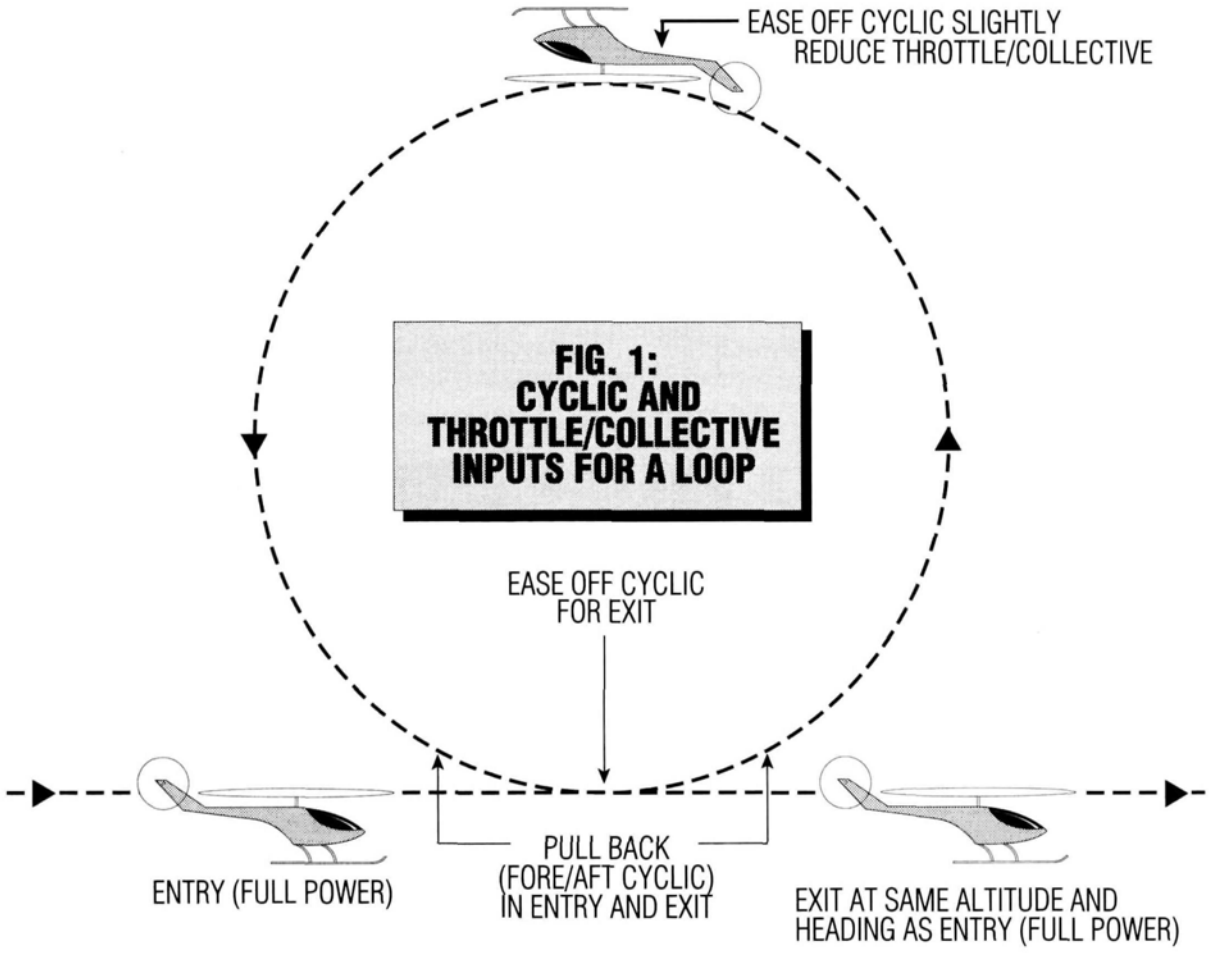


FIG. 1: CYCLIC AND THROTTLE/COLLECTIVE INPUTS FOR A LOOP

WELCOME BACK! I hope that you've had a chance to get out and practice autorotations during the last month. If you haven't been successful, keep trying; the only way you'll learn is by doing. This month, I'll discuss the most basic aerobatic maneuver: the loop.

FLYING THE LOOP

The loop is an aerobatic maneuver you can have fun with, and it's one of the "building blocks" for all aerobatics. Although it's probably the easiest model-helicopter maneuver to do, there's a difference between doing a loop and doing it *well*.

Here's what a truly well-done loop is like: the helicopter enters it flying straight and level and on a heading that represents a line parallel to the flight line or show line. When the helicopter is directly in front of the pilot, he makes it pull up smoothly and describe a perfect circle in the sky. At the end of the loop, the helicopter is at exactly the same point and heading as when it began. It exits straight and level and at the same altitude and heading as its entry.

Loops require a constant rotor-speed setup (see my December '90 and January '91 columns), and they're flown in the same mode as normal forward flight. If your radio has one or more high-idle systems, and you set it for aerobatics (i.e., 3 to 4 degrees of negative pitch with the matching throttle curve), you can do loops in this mode. Very little negative pitch is used as the helicopter goes over the top so, if you decide to fly your loops in the high-idle aerobatics mode, you'll have to fly the collective with more precision. In this mode, you'll rarely need to pull the collective stick down below the halfway point or the zero-pitch point, but you'll have the advantage of being able to get extra lift over the top when you make larger loops.

(Continued on page 104)

HELICOPTER CHALLENGE

LOOP LESSONS

First, try a few simple loops without making corrections. Start quite high up so that you'll have plenty of time to recover if anything goes wrong. With the helicopter in straight and level flight at full or nearly full power, pull back on the fore/aft cyclic, and let the helicopter come around onto its back. At the top of the loop, ease off the back cyclic slightly. As the heli's nose heads toward the ground, pull back on the cyclic pitch ("up-elevator" for you fixed-wing guys) again. Then, as the helicopter pulls back to level, ease off the back cyclic and let the heli fly away. Don't just "haul" the cyclic-pitch stick all the way back. Allow the helicopter to come smoothly through the loop without making corrections to it. Repeat these simple loops until you feel comfortable doing them.

Next, work on maintaining a heading and making the loops more rounded (rather than egg-shaped as they probably are now). By now, you should know what size loop your helicopter can do easily. Envision it performing a perfectly circular loop of this size. After you've flown the first round loops at this size, you'll find that they'll become larger as they become more rounded.

Enter the loop in the same way as before, and be sure to make the initial pull gradual and smooth. As the helicopter comes over the top to an inverted position, reduce the throttle/collective and relax the back cyclic so that the helicopter won't tuck inward and make the loop egg-shaped. Now, let the heli float through the third quarter of the loop, making sure that its heading and attitude haven't changed. As it comes down into the fourth quarter of the loop, reapply back cyclic and begin feeding in throttle/collective.

At the end of the loop, the helicopter should be at the same point and heading as when it began. Exit at full power, keeping the nose level (you'll probably need a touch of forward cyclic to push it back to level).

Easy, right? Well, performing egg-shaped loops with a well-setup machine is simple, but if you practice making perfect circles as I've described, they'll be quite challenging.

Here are a few final notes about loops. If your machine's horsepower is marginal for its weight, loops can be very difficult. I've flown helicopters that just didn't have enough power to get over the top. Consider buying a more powerful engine or a helicopter with a more aerobatic design. Also, make sure that you have plenty of cyclic-pitch throw—enough to let you use less than full stick travel for the loop. This way, you'll have a little left over if you need to pull out in an emergency (i.e., the ground coming up too soon!).

MESSAGES

My apologies for the photo-caption mix-up in the Merced R/C Helicopter Fly-In report (February '91, page 100). I incorrectly identified Tom Wise's model of a Sikorsky CH-53E as a Westland Sea King; and also incorrectly identified a Boeing Vertol Chinook as Tom Wise's CH-53E—sorry about that!

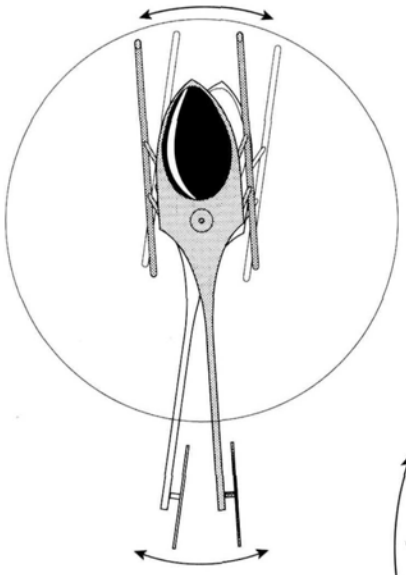
On a sad note, I recently learned that Walt Schnooard, founder of Miniature Aircraft USA, has died. Walt was this column's first author, and truly one of the hobby's pioneers. Over 10 years ago, when I was learning to fly R/C helis, Walt inspired me. He leaves Miniature Aircraft (which produces X-Cell helicopters) and its traditions in the capable hands of his family.

Next month, I'll discuss stall turns and how to combine them with some other neat maneuvers. See you then. ■

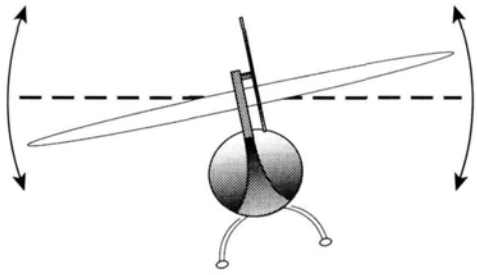
LOOP ERRORS

Some of the most common "loop errors" involve tracking and heading. If your helicopter's tail-rotor torque-compensation system is working properly, it will be easier to keep the tail rotor straight during a loop. (See my February '91 column on this subject.) Be sure you don't have to hold in any tail-rotor pitch to keep the nose straight away in forward flight. If you do, you'll have to make a really complicated set of corrections as the helicopter flies through the loop. To avoid this, shim the vertical fin, and try to keep your hands off the tail-rotor pitch unless you have to use it to correct the heading.

It's also very important to keep the rotor disk level on the roll axis throughout the loop (this is similar to keeping the wings of an airplane level through a loop). If the rotor disk isn't level, the loop will be tilted or off-heading. Correct this problem as soon as you detect it. As your skill and confidence grow, try to make your loops bigger and smoother until they're large, graceful and perfectly round.



A. TAIL TRACKING



B. ENTRY NOT LEVEL

FIG. 2: LOOP ERRORS

ROTARY-WING ROUNDUP

GREAT PLANES MODEL DISTRIBUTORS
Kyosho's Concept 30SX

Kyosho's newest heli in the Concept 30 Series—the Concept 30SX— evolved to meet the needs of top-level fliers. The newest features of the Concept 30SX include greater collective-pitch range, thrust bearings in the rotor head, metal pivot balls throughout the rotor head and on the swashplate and a new canopy with improved decals.

Part no. KYOE0280. *Price: $519.95*

For more information, contact Kyosho/Great Planes Model Distributors, P. O. Box 4021, Champaign, IL 61824.

GREAT PLANES MODEL DISTRIBUTORS
Concept Accessories

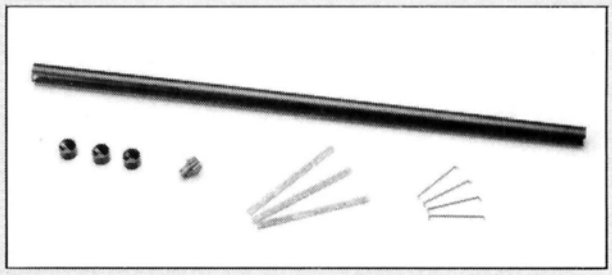
Great Planes Distributors offers several accessories for its Concept Series helicopter line. These include:

- a new, hardened-aluminum pinion gear in anodized gray for the Concept 30. (No more messy black grit will be deposited on your main gear.)

  Part no KYOE6055. *Price: $24.95.*
- fiber clutch liners used for spares in KYOE5042 drive gear.

  Part no. KYOE2156. *Price: $5.29/bag of 3.*
- DX shaft guides.

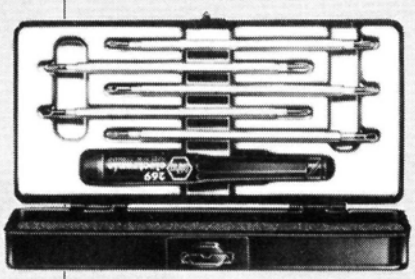
  Part no. KYOE3121. *Price: $9.95/bag of 3.*
- special pitch rods can be used with either of Kyosho's two metal mixing bases.



  Part no. KYOE5106. *Price: $1.39/ bag of 4.*
- carbon tail boom—light and very strong.

  Part no. KYOE6070. *Price: $69.95.*

For more information, contact Kyosho/Great Planes Model Distributors, P. O. Box 4021, Champaign, IL 61824.

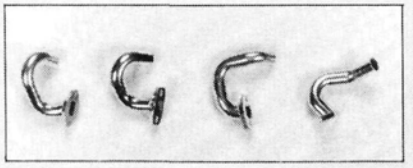


BONDHUS CORP.
Reversible-Screwdriver Sets

Wiha Tools now offers Precision Reversible-Screwdriver Sets. These screwdrivers have the distinctive Wiha handle (tapered, with a fingertip rotation cup on the end) and reversible, dual-tipped, hardened, plated-tool steel blades, which have precision oxide tips. Two sets come in a compact, durable steel box that makes them easy to transport and store. (All Wiha products are available in sets or individually.)

Part nos. 26993 (six pieces: slotted and Phillips tips, one handle and five reversible blades with tips on both ends); 26994 (11 pieces: slotted, Phillips and hex/ball tips).

For more information, contact: Bondhus Corp., 1400 E. Broadway, Monticello, MN 55362.

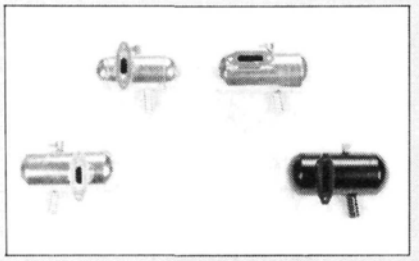


MINIATURE AIRCRAFT Headers

Miniature Aircraft offers a variety of .60-size headers for use with Peacemaker-style exhaust pipes. These include (from left to right in photo): side exhausts (nos. 3994 and 3968); rear exhaust (no. 3993); and side exhaust for Schluter machines (no. 3991).

Price: $39.95

For more information, contact Miniature Aircraft USA, 2324 N. Orange Blossom Trail, Orlando, FL 32804.



MINIATURE AIRCRAFT Silencers

Miniature Aircraft offers several .28- to 35-size muffled silencers that are suitable for a variety of helicopters from different manufacturers. These include (clockwise from the left):

Part no. 3974—Hirobo Shuttle. *Price: $39.95.*

Part no. 3965 (.28)—Hirobo Shuttle. *Price: $29.95.*

Part no. 3973—Concept 30. *Price: $ 39.95.*

Part no. 3974—X-Cell 30 and Kalt .30 MX. *Price: $39.95.*

For more information, contact Miniature Aircraft USA, 2324 N. Orange Blossom Trail, Orlando, FL 32804.

COMPUTERIZED FLIGHT SIMULATION

R/C AEROCHOPPER

Above: The R/C Aerochopper system includes a modified Futaba Conquest transmitter, a ROM program cartridge and an instruction manual.

by BILL GRIGGS

EVERY WINTER, we Northern fliers are grounded because the weather is better for frostbite than flying. Sure, you can fly off snow, but I prefer to leave that to the birds, and I wanted a way to fly without worrying about the weather. While at the Toledo R/C Exposition in 1987, I wandered to the rear halls where smaller vendors had set up displays. I made my way through the crowd milling around one of the booths, and saw the answer to my prayers: R/C Aerochopper.

By Ambrosia Microcomputer Products, R/C Aerochopper (RCAC) is an R/C flight simulator for the Atari ST line of computers. The RCAC is manufactured and packaged for Ambrosia by Futaba*, and it comes complete with a 90-page manual, a Futaba Conquest transmitter, connecting cables and a ROM cartridge programmed with 32 flight options. A free disc upgrade that will allow the use of a less expensive monochrome monitor and add two idle-up throttle settings for chopper fliers is also available.

The genius behind this program is David Stern, who spent more than three years on its development and it shows. I've spent literally hundreds of hours playing with this software, and I haven't found a bug or crashed the program.

The RCAC requires an Atari ST computer and a color monitor, a color TV or a black-and-white monitor. Since the program is cartridge-based, you don't need an expensive disc drive, but if you have one, the program can take advantage of it.

David Stern chose the Atari ST because it's powerful, but inexpensive. It runs this type of program faster than the Commodore G4 and stock IBM PC XT. Ambrosia plans to release versions of theAerochopper for the Apple Macintosh and Commodore Amiga systems in February 1991. If demand is sufficient, there will also be a version for IBM and compatibles.

HARDWARE

The transmitter is a Futaba Conquest transmitter, minus the electronics needed to transmit a radio signal. It has the same gimbals as a regular Conquest but no trim tabs. Two push-button switches are mounted where dual-rate switches normally go, and these buttons can be used to set many other functions. (More on this later.)

The program is easy to install on a computer. A cable comes out of the transmitter's antenna hole and plugs into the program ROM cartridge, which is then plugged into the cartridge port on the side of the computer.

SPECIFICATIONS

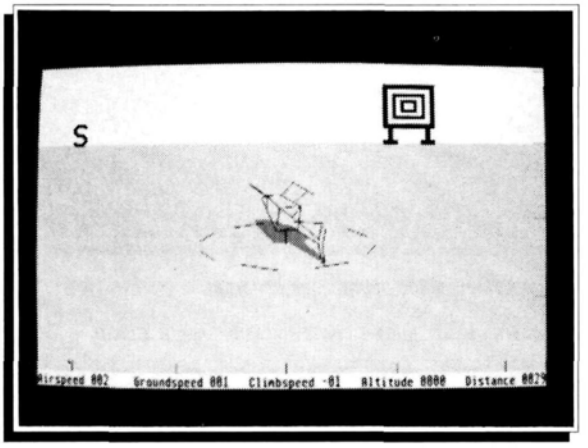
Software Type: **R/C helicopter and fixed-wing flight simulator**

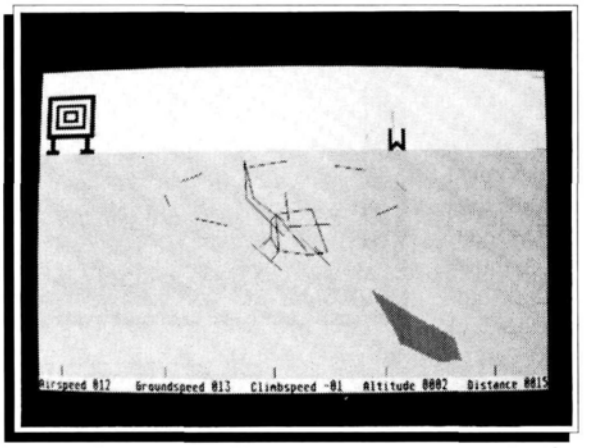
System Requirement: **Atari 520ST, 1040ST, or any Mega ST (a version for the Apple Macintosh and Commodore Amiga systems is scheduled for release during the first quarter of 1991); monitor (monochrome or color); Commodore Amiga or Apple Macintosh**

Sug. Retail Price: **$199.95**

Features: **the system includes a modified Futaba transmitter and a program ROM cartridge. A disc upgrade is available.**

Comments: **this flexible, realistic flight simulator gives the "feel" of true R/C flying and is recommended as a training aid for heli and fixed-wing flight. Although comprehensive, the manual contains typographical errors.**





Above: An inverted hover, 1 inch off the deck.

Right: A nose-in hover. The missile target is in the background, on the left.

Below: Author flies R/C on his computer.

GRAPHICS

The program uses three-dimensional line drawings to represent aircraft. The animation is lightning quick because the program uses its own ROM memory bank and not the computer's. The plane's movements are smooth—unlike those found in some other flight simulators currently on the market. The flight demo, which I recommend, will give you an idea of how this program can perform in the hands of a good pilot, and it really shows off the graphics.

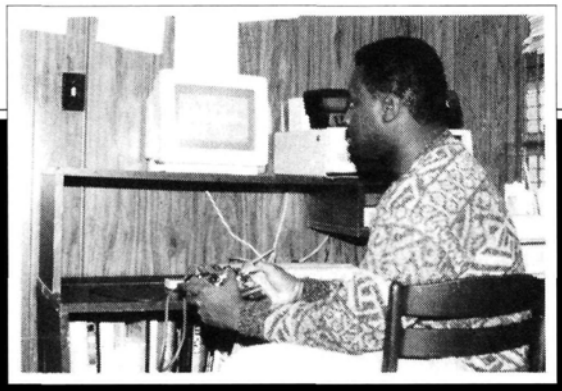
To use the program, you first select either "Fly airplane" or "Fly helicopter" from the main menu. If you select the latter, you have a choice of a Bell Jet Ranger, a Hughes 300, or a pod-and-boom-type chopper. If you selected airplanes, then you have four to choose from: a high-wing trainer, a low-wing pattern plane, an F-15 ducted fan and a glider.

FLYING

Flying the program is just like flying an actual R/C aircraft; the "feel" is just the same. I've been able to transfer moves I learned on the simulator to the real thing—split S's, Cuban-8s, top hats; any maneuver is possible.

Here are a few words of advice: make all control movements in small increments until you get used to flying this program. If you bang the sticks from stop to stop, your plane will also bang—into the ground!

My favorite trick is to pull back hard on takeoff, chop the throttle and pray I can pull out of the tail slide before I hit the ground. It's a

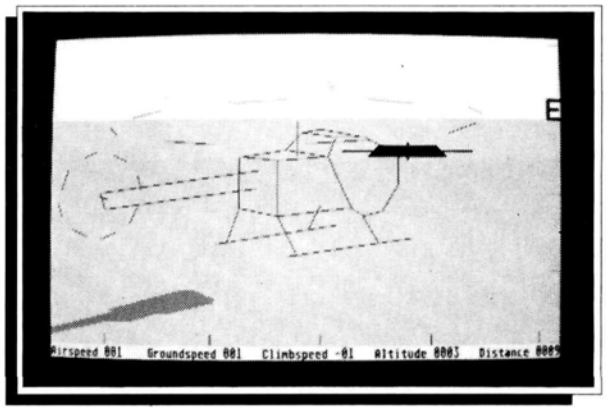


FLIGHT TRAINING

I feel strongly that this system is the most economical way to teach heli flying. The "learning curve" can be shortened considerably by allowing the student to get the feel of flight without the worry of crashing a $1,000 machine. Ted Mahl, an experienced fixed-wing pilot, spent about an hour on RCAC and learned to hover in one weekend. He exhibits better-than-average control of the tail rotor and has never really got into trouble in the air.

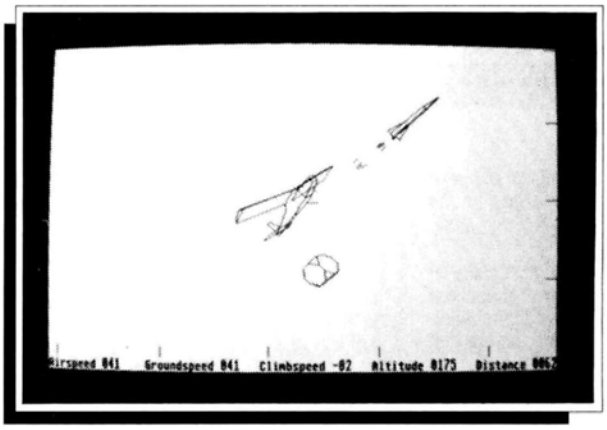
Frank BaRossi (a rank beginner; a fixed-wing student pilot) spent two hours on RCAC on the day before his first flight. At the field, he successfully followed my flight instruction and is well on his way to soloing. Frank can set up for a landing approach and do figure-8s (not bad for his first day!).

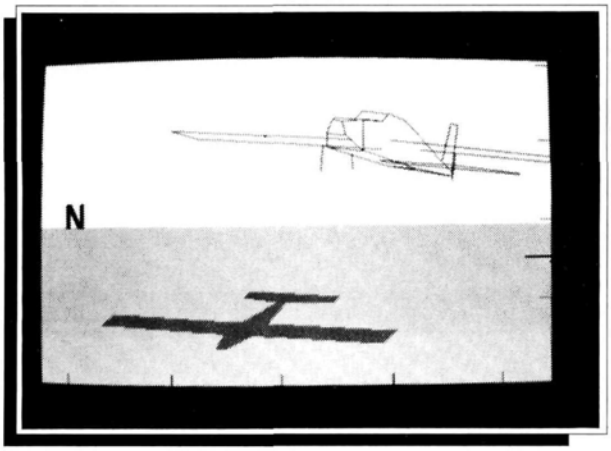
I think the success of these pilots resulted from their increased air time. They also gained confidence in a relaxed learning environment in which they didn't have to be concerned about damaging an aircraft. Learning was simply more fun.



Above: A Hughes 300 approaches its target.

Below: Trainer dropping a bomb and launching a missle.





Right: A pattern plane on final

lot cheaper to do this on a flight simulator than with the real thing!

Another good thing about this program is that it allows you to practice advanced heli maneuvers. Autorotations are similar to those done with an FAI ship in that you can steer the tail all the way down. Inverted flight 1 foot off the ground is easy to do when you can crash hundreds of choppers when learning. Have you ever seen an inverted stall-turn pirouette? It's spooky!

I recommend that you start out with option no. 0000 because it's the easiest, most forgiving plane to fly but can become boring rather quickly. For the hot dogs among you, option no. 0029 is awesome—expect speeds in excess of 200mph

CUSTOMIZED WEATHER

The R/C Aerochopper has many special features. By selecting from a variety of menus you can change your aircraft's responses (as if you had a computer radio) or the conditions under which it flies. The wind menu allows you to change the wind speed, which can be varied from no wind to hurricane force. You can also control the size and strength of thermals (hot rising air) for glider flight. You can also affect other features, e.g., wind direction and frequency of gusts.

OTHER SPECIAL FEATURES

The camera can also be varied. It can be set at any height up to 790 feet; you can control the field of view it displays; and it can be set to follow the plane and keep it centered on the screen. It can also be set stationary or for "wrap around" (the default mode).

For you "Top Guns" out there, there are two combat modes. The first allows you to try to shoot down target drones in a 5-minute timed run. (Use the dual-rate buttons to launch missiles and drop bombs.) The second is for two players: two ST systems with RCAC installed can be connected through the MIDI (Musical Instrument Digital Interface) ports, and you can race, fly in formation, or shoot it out.

There are more than 150 major parameters that you can change, so you really can customize its performance.

CONCLUSION

Although the manual is complete and covers all aspects of the program, it's full of typographical errors. I've been assured that the errors have now been corrected, and the problem detracts only slightly from the program's appeal.

The R/C Aerochopper is one of the most enjoyable programs I've ever owned. Its "feel" is so similar to actual flight that I recommend it for training newcomers. If you want the freedom of flying R/C aircraft without worrying about the weather or the cost of crashes, Aerochopper is for you.

**Here's the address of the company featured in this article:*
***Futaba Corp. of America,** 4 Studebaker, Irvine, CA 92718.* ■

AS WE GO TO PRESS

Ambrosia announces a new upgrade that's available free to registered owners! It has the cartridge electronics built into the transmitter; it plugs into the printer port instead of the cartridge port; and it's disc-based to allow easier upgrades.

New features include a new idle-up setting to allow inverted hover without a switch (à la Mike Mas) and three new airplane parameters. A new center-of-gravity function allows you to vary the CG's location to simulate a nose-heavy or a tail-heavy plane.

Three new display features have been added, too. Telescopic viewing lets you see the attitude of the plane when it's far away. (This may be compared to flying by means of telemetry.) On the left of the screen, there's now an attitude display bar that rises and falls to show your height above ground.

Finally, there's a crash-warning color display. It senses the aircraft's rate of descent and compares it to its height. The screen changes color to warn you to pull up—or you'll crash!

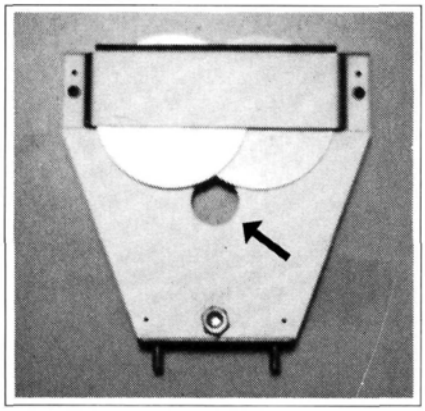
HIGH POINT BALANCER MODIFICATION

BALANCE ROTOR HEADS WITHOUT COUNTERWEIGHT

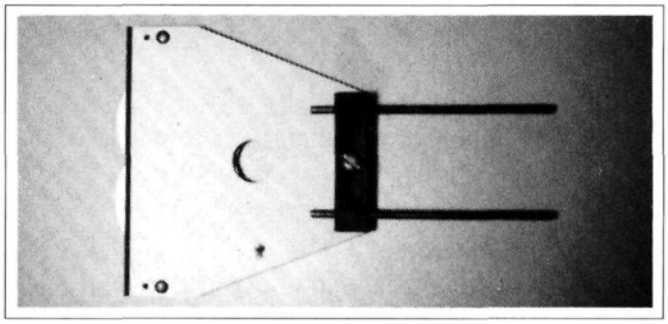
by PHIL NOEL

MOST HELI EXPERTS recommend that you use a High Point* Balancer (HPB) and a specially weighted shaft to balance a completed rotor-head assembly (including the flybar and the blades). I don't want to take business away from Yale Hobby* or the other manufacturers that sell specially weighted shafts, but they aren't really necessary.

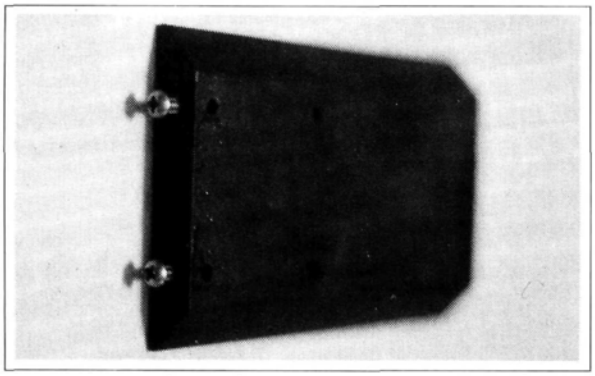
To balance spinners, propellers, etc., on the HPB, you put them on a shaft and balance them between two roller assemblies. In its current configuration, the HPB's roller assemblies are parallel to and level with each other. Because of this, anything that's balanced at one end of a shaft must be counterbalanced at the opposite end. By changing the roller-assembly configuration, you'll be able to use the HPB to balance heavy, one-sided objects without having to counterweight them. With these easy modifications, you'll be able to use a standard (ungrooved) shaft, or any short, straight shaft of the proper diameter.



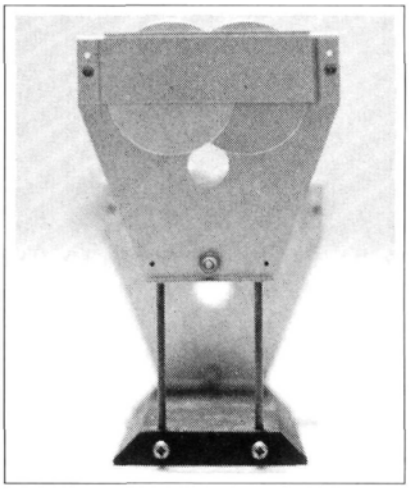
1. Each roller assembly has a hole in its center through which you can see the lower part of the intersection of the two rollers.



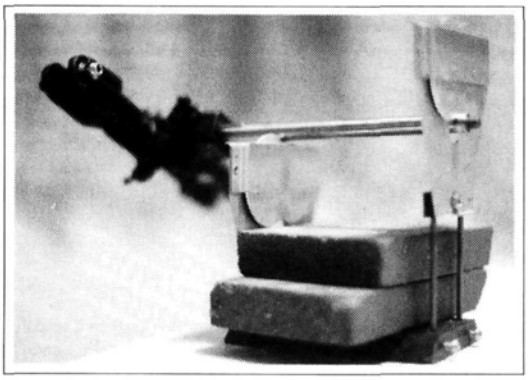
2. Each roller assembly also has two, short, wire legs that are attached to it with a nut and a bolt. (These legs are used to attach the assembly to the base.) To raise one of the assemblies, remove the nut and rotate the legs 180 degrees.



3. In one end of the base, drill and tap two holes for 4-40 setscrews so that they intersect the two existing vertical holes. (This end will be the rear of the modified HPB.)



4. To assemble the HPB, insert the roller assembly with the short legs into the vertical holes in the front of the base. Insert the taller one into the vertical holes in the rear and secure it by tightening the setscrews in the end of the base.



5. The bottom of the rollers in the taller/rear assembly will now be aligned with the top of the rollers in the front assembly. Insert a main rotor-head assembly that's complete with a standard main shaft, and balance it according to the instructions in any helicopter manual. Note: the assembly should hang over the edge of the workbench by an inch or two, so you'll have to weight it down (as shown) to secure it to the bench.

Now the HPB can quickly and easily balance rotor-head assemblies without the added expense and bother of a weighted, after-market shaft.

*Here are the addresses of the companies mentioned in this article:
High Point Products, 3013 Mary Kay Ln., Glen View, IL 60025.
Yale Hobby Mfg., 3896 Selvitz Rd., Ft. Pierce, FL 34981.* ■

PHOTOS BY PHIL NOEL

(Continued from page 91)

are commercially produced engines with quite mild exhaust timing. Out there, rocketing around, are FAI 2½cc engine performances of 39,000rpm and 1.7hp on methanol fuel, obtained using 198-degree exhaust and a tuned pipe. This is a very narrow, "peaky" performance to be sure, but it's one that Fred Baldwin surely has in mind when he threatens to come up with a 4hp .40-size engine (11 b.hp/cubic inch). We seem to be rapidly approaching that model engineer's "4-minute mile"—the 1hp-per-cc output.

The Shuriken 0.050 torque figures of 9 ounce/inches and maximum hp of 0.28 at 34,424rpm are way above those earlier test results. Not only have the rpm-related hp levels been hugely increased, but the Schnuerle porting has considerably increased torque levels also. Torque obviously declined at around 36,000rpm, so I ended this particular test of the smaller Shuriken engine at 39,000rpm.

Test 2: .061 rear-exhaust engine—open exhaust. Fuel as in Test 1. Venturi: .180 inch.

Having the same stroke as the smaller engine (0.400 inch), but being bored out from 0.399 inch to 0.441 inch, just gives the .061 an "over-square" stroke/bore ratio, while the smaller engine is unusually "under-square." As a result of these changes in dimension, the .061's effective compression ratio, i.e., after exhaust port closes, is greater (7.5 instead of 5.5). Both ratios are quite low and possibly more suited to the boost provided by tuned-pipe use. The venturi is the largest of those supplied.

As expected, with its larger cylinder capacity, compression ratio and venturi, the 0.061 had a higher performance all around and a final—shattering!—maximum rpm of 47,800, with a b.hp maximum of 0.36 at 36,624rpm.

Test 3: .061 rear-exhaust engine with full-length minipipe. Fuel and venturi as in Test 2.

Results with this standard minipipe (4.4 inch from plug to end) showed that its length caused the best resonance at a fairly low 22,000rpm. This combination seems better suited to the Cox (gray) 5½x4 prop, though it was clearly well below the engine's potential.

Test 4: .061 rear-exhaust engine; shortened minipipe. Fuel and venturi as in Test 2.

This shorter minipipe (3.2 inch from plug to end) allowed best resonance at

(Continued on page 114)

ENGINE REVIEW

(Continued from page 113)

32,000rpm—nearer the engine's natural, open-exhaust, peak point. Shortening it further (say, to 2.8 inch) would more accurately match it to the "natural," best rpm point of 36,000rpm, and although I didn't do that, a final maximum b.hp close to 0.38 is probable. Using the tuned pipe, higher exhaust timings and even more nitro can only lead to an ever more cautious approach to the dyno, and, as suggested earlier, to a highly possible 0.5hp or more.

In all the test runs, plug life was marginal when 36,000rpm was exceeded on the 50-percent-nitro fuel.

Sharp-eyed readers might notice that the propeller rpm recorded here are a little below some of the figures shown in the manufacturers' documentation. This type of discrepancy happens occasionally and is the result of geographical location and atmospheric conditions—in particular, air density. This problem has been with us since the beginning of the internal-combustion engine; rpm can't be precisely guaranteed under all conditions. We do, however, have the "correction factor," which can be applied to all hp findings and which, of course, varies with atmospheric conditions! With all my engine tests, I apply this factor and, this time, I obtained a modest, fairly normal figure (for this site) of 1.021.

SUMMARY

High-tech is alive and well in Indianapolis, and if you're looking for high rpm and horsepower, you'll have to join the lengthening line of direct purchasers. If, however, you seek the quiet, gentle life, don't even approach these Shuriken machines, because they'll outlast and outrun your reserves. ■

SUNFLY

(Continued from page 97)

at a wing loading of about 21.5 ounces per square foot, which is higher than that of many sport planes. For extra washout, consider raising the ailerons just a little while you learn how to handle the Sunfly. Though the wing loading is high, the glide is super. My first landing was a little high on the approach, and this resulted in a very long walk for me. (Fortunately, I have access to a large flying field.)

To improve landings, the alternate set-up feature of the Vision radio with "crow"

(Continued on page 116)

SUNFLY

(Continued from page 114)

added provides improved glide-path control: raising both ailerons increases the sink rate enough to gain good control on landing approaches.

I've flown the Sunfly with the Graupner* 11x7 scimitar-blade folding propeller, the 10x6 propeller and the Freudenthaler 11x6½. In a static test, the 11x7 propeller drew 38 amps at 8,200rpm. The motor run lasts only 2 minutes at this rate, but with the glide, that's enough for a 15-minute flight or more without lift. The 10x6 gives a slightly longer motor run with a slightly decreased climb rate. If you wish to keep the current draw down, consider using 12 cells or a 10x6 propeller.

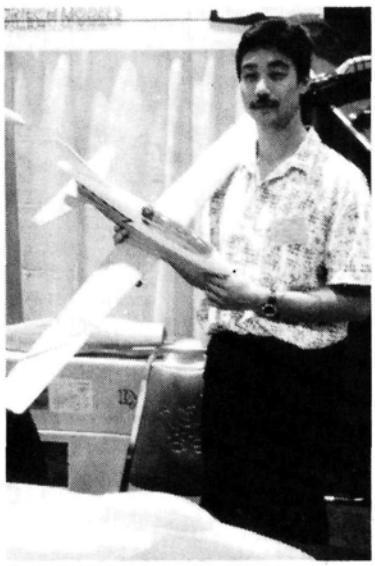
There's plenty of power—enough to pull the ship through very large consecutive loops. The glide is excellent but much faster than those of typical electrics or sailplanes. I flew the Sunfly at three model clubs, and everyone was impressed with its climbing, aerobatic capabilities and soaring. Some had never seen this type of performance from an electric ship, or even thought it was possible.

(Continued on page 126)

QUIET FLIGHT

IMS SHOW; PROJECT EXPLORER

by JOHN LUPPERGER



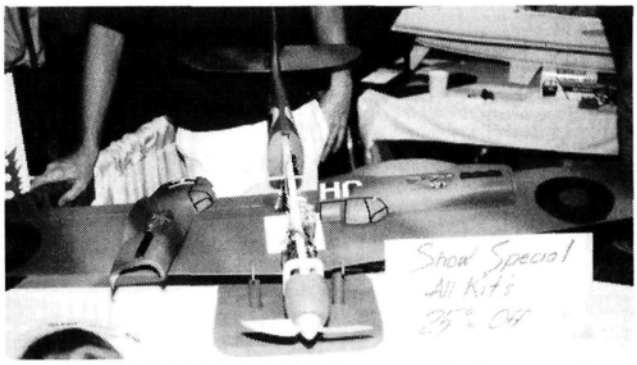
Vortech Models' small BD-5 slope glider has a fiberglass fuselage and foam-core wings.

ONE OF THE things I look forward to at the beginning of every year is the start of the hobby trade-show season. I live in California, so I can attend two of the year's earliest shows: the International Modelers Show (IMS) in January and the Hobby Industry Association Show (HIAS) in March. At this year's IMS, there weren't as many new products as in past years, but there were some very interesting ones!

PRODUCT REPORTS

Dickybird Models* is a new company, and its approach to kitting is refreshing. Although the company calls its models ARFs, I'd classify them as "almost" ARFs. They require very little building, but you still have to do all the finishing.

Dickybird has four new offerings that should be of interest to "quiet" fliers. Two of them—a British Kirby Kite and a German Gruanau Baby—are classic gliders from the '30s. Both feature vacu-formed plastic body pods, fuselage keels made of lite-ply and balsa, balsa-sheet wings and optional spoilers. They're 31 inches long, weigh 27 ounces and have 72-inch wingspans with wing areas of 390 square inches. They require 2- or 3-channel radios.



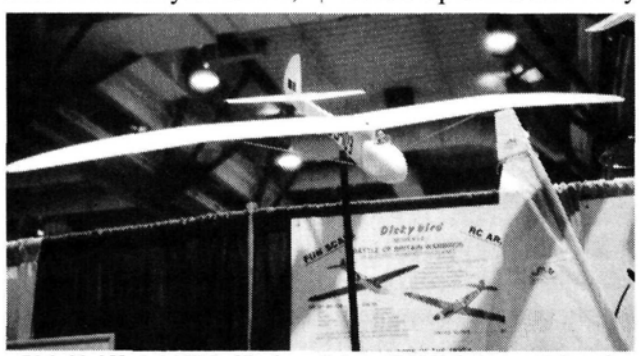
You can build Dickybird Models' Spitfire as an electric or as a slope glider. Its fuselage shell fits over a central keel that houses the radio and flight equipment.

The other two models can be built as electrics or gliders. The Me-109 and the Spitfire (of WW II fame) feature vacu-formed plastic bodies and tail cones, full decal sheets, machine-cut balsa stabs, fuselage keels made of lite-ply and balsa, balsa-sheet wings and unique Dickybird high-lift airfoils. These 60-inch-wingspan (420-square-inch wing area) models weigh 27 ounces (glider) or 44 ounces (electric), and they're perfect for those who want to get into the air fast. The ones I saw at the IMS looked as if they'd be ready to finish in 2 to 4 hours.

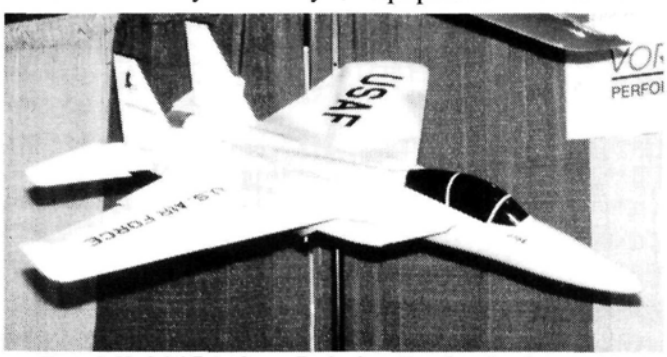
POWER SCALE SLOPERS

Vortech Models* is known for its Power Scale Slopers—the P-51 and the Zero-Sen—and the company is adding two more PSS models and one sport-type model to its line. The kits feature fiberglass fuselages, foam-core wings and machine-cut wooden parts. They can be built quickly and are quite rugged.

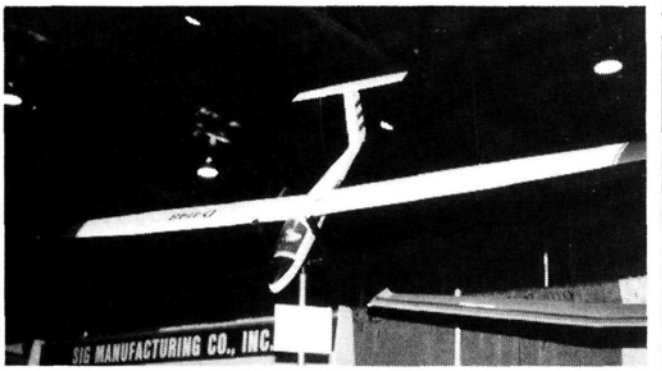
One of the PSS models is a 46-inch-span BD-5. It's 22 inches long, weighs 17 ounces and requires 2-channel mini-gear radio equipment. The 45-inch-



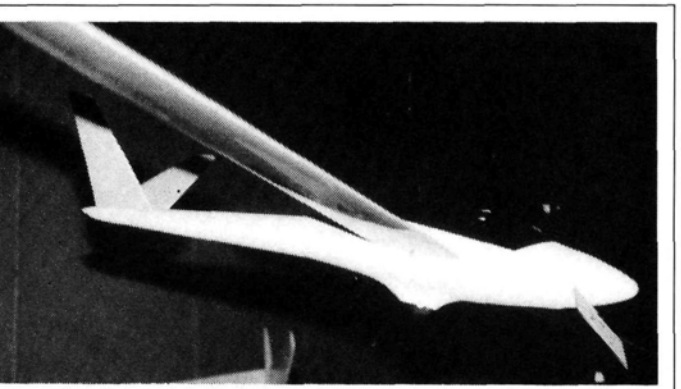
Dickybird Models' Kirby Kite is an "almost" ARF vintage sailplane for slope soaring.



Vortech Models' F-15 Super Eagle has fiberglass fuselage and foam-core wings.



This 2-meter Pilatus B-4 has a fiberglass fuselage and foam-core wings, and it's controlled by pivoting wings instead of ailerons.



VS Sailplanes' Salto features "pitcheron" wing control for roll and pitch. It can also be built to use "wingerons" and conventional elevators.

span F-15 Super Eagle (also a PSS) is 46 inches long and weighs 50 ounces. The sport-type 54-inch-span V-1 Viper is 33 inches long and weighs 26 ounces. The F-15 and the Viper both require 2-channel standard radio equipment. (No specifications were given in the show literature for wing areas). I've seen the P-15 and the Zero fly, and I assume that the new planes will be fairly hot aerobatic models.

Milo Model Products* has added two new models to its line, which already includes the Sailaire; the 1/3-scale ASW-20; the redesigned Mini Bird of Time (with a fiberglass fuselage and a Selig 3021 airfoil); the pocket-scale LS-3; and the Phoebus. New to the line are the PSS 1/8-scale Model 35 Gates Learjet and the Pilatus B-4.

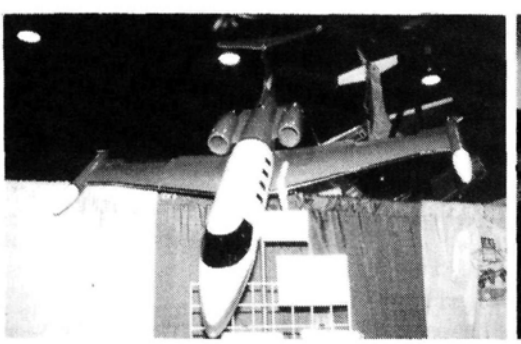
The Learjet is a partial kit that includes a fiberglass fuselage and engine nacelles, vacu-formed tip tanks, and foam-core wing blanks. This 65-inch-span model has a wing area of 626 square inches and weighs 5.25 pounds. It requires a 2- to 5-channel radio, depending on the number of scale functions you want. The big, impressive Learjet will surely turn heads at any slope!

The 2-meter-span Pilatus B-4 is a small-scale model that should be able to stay aloft in light air that would ground most larger scale models. It features the well-known Eppler 205 airfoil (that works so well on the slopes and for thermaling), a fiberglass fuselage, a foam-core wing set and sheeted tail surfaces. The Pilatus has a wing area of 412 square inches, and it's controlled with pivoting wings, rudder and elevator. It requires a 3-channel radio.

VS Sailplanes*, maker of the Rotor, the Vmax and other high-performance slope and thermal sailplanes, has done it again. Each year, VS introduces two or three new sailplanes. (Considering the type of quality kits and high-performance models that the company produces, this isn't easy to do.) This year's models are a semi-scale Salto and an aileron version of the Rotor.

The Salto was designed to fly in light- to medium-lift conditions on slopes; and in medium-lift conditions, it's capable of mild aerobatics. It features "pitcheron" control (i.e., the wings pivot for both roll and pitch control, and the tail surfaces are fixed). It can also be built to use "wingerons," where the wings control roll and conventional elevators control pitch. The kit features a 4-ply fiberglass fuselage with a wheel fairing, a clear canopy, wing cores, wing skins, all the necessary wood and hardware, and full-size drawings and instructions. (No specifications were given in the show literature.) This neat, small-scale sailplane should really excite scale-slope fliers.

The aileron-equipped Rotor was designed for those who want the Rotor's high-performance capabilities with conventional controls. It should be easier to set up and fly than its predecessor, which is "pitcheron" controlled. It features a beautiful fiberglass fuselage and a foam-core wing construction. Its elevator has been changed from a T-tail configuration to a conventional one. This is a fast, aerobatic ship that will satisfy the most demanding pilots, and the components in VS kits are always of a high quality, so you definitely get your money's worth.



■ *Far left: Milo Models' Gates Learjet 1/8-scale Power Scale Sloper comes as a partial kit and has a fiberglass fuselage, vacu-formed parts and foam-core wings.*

■ *Left: VS Models' aileron-equipped Rotor should be easier to set up and control than the original "pitcheron" version.*

Douglas Aircraft's electric Breeze is based on the popular and successful Quicksilver slope glider.

Douglas Aircraft* has decided to try something new. The company took what it learned from its successful Silhouette and Quicksilver slope gliders and produced the new Electric Breeze. This 52-inch-span model features a built-up fuselage, sheeted tail surfaces and foam-core wings that use a Selig SD6060 airfoil. It has a wing area of 362 square inches and requires a 7-cell .05 electric motor for power. The Breeze is supposedly capable of excellent aerobatics using a ferrite motor, and using a cobalt motor, they say it's something! I've seen the Quicksilver sloper fly (the Breeze uses the same wing and tail group), and it's quite a performer, so I believe the claims about the Breeze's aerobatic capabilities.

HOBIE HAWK NEWS

At the IMS, I found out from Bob Martin Models that the Hobie Hawk will be available again, but not from them. The tooling has been bought by Ross Models Inc.,* and the initial production quantities will be limited and available only through Ross. This is certainly good news for those who love the Hobie Hawk. For more information on kits, parts and prices, drop Ross Models a line.

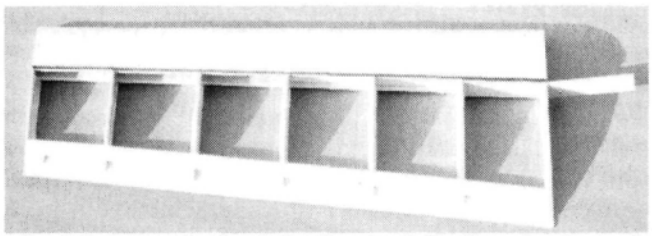
PROJECT EXPLORER 2M

In this issue, we'll work on the tip panels and, in the next issue, we'll finish the center section and the spoiler modifications.

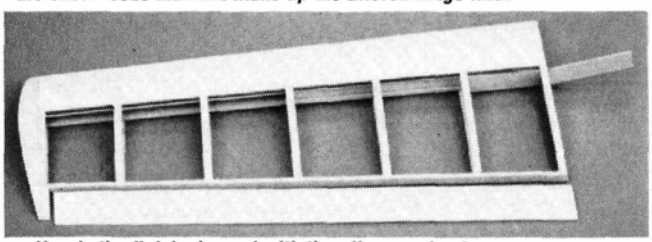
Turn to page 6 of the Explorer instructions and start with the section that begins, "The right outer wing panel...." Pin down the leading-edge sheeting and glue the spar into place as specified. Cut a 1 3/8-inch-wide piece of trailing-edge sheeting to replace the 7/8-inch piece that's supplied in the kit. Cut the capstrips and glue them into place between the leading- and trailing-edge sheeting, and set the root rib using the kit-supplied dihedral jig. For the first bay, cut a new shear web that's 3/8 inch wide (same size as the spar), and glue it directly over the bottom spar. Glue the remaining ribs and shear webs in place according to the instructions.

Cut 12 pieces of 1/4x1/2-inch medium-hard balsa into strips just over 3 inches long. Glue these between the ribs at the front edge of the new trailing-edge sheeting, and make sure that each one fits exactly between the ribs. At the root ribs and the tip ribs, glue a small, 1/2-inch-wide piece of trailing-edge stock between the rib and the bottom sheeting.

Cut out the plan illustration that shows the tip section's dihedral angle. Glue it to a piece of 3/32-inch plywood, and cut two new dihedral braces. Make them the same height as the spars so that they'll just fit under the capstrips. Cut a slot in the root rib to accommodate the dihedral brace, and epoxy it to both spars and the shear web.



Here's the Explorer's wing. Notice the extended trailing-edge sheet and the shear webs that will make up the aileron hinge line.



Here's the finished panel with the aileron cut out.

Now comes the hard part. Using an 11-inch T-bar sander, taper the hinge-line shear webs to match the top-edge contour of the ribs. Do this carefully so that you don't change the rib profile. When you've finished this, complete the outer panel according to the instructions, but don't glue the tip block on yet.

To cut out the aileron, use a Dremel table saw or a band saw with a "tiltable" table or saw blade. Cut at a 30-degree angle, and adjust the cutting guide to leave 3/32 inch of the shear-web material attached to the ribs on the wing's top side. Cut the aileron free, set the saw to cut at a 90-degree angle, and remove the angled material from the main wing panel. To reinforce the trailing edge, glue a piece of medium-hard 1/16-inch balsa to it. Glue on the tip and then cut a 5/16-inch strip from the tip of the aileron. Glue this piece to the wing tip at the trailing edge and shape the tip. Finish-sand the tips, and in the next issue, we'll finish the rest of the wing.

Till next time...good thermals and a full charge!

**Here are the addresses of the companies mentioned in this article:*

Dickeybird Models, *P.O. Box J, Westminster, CA 92684.*

Vortech Models, *P.O. Box 15132, Long Beach, CA, 90815.*

Milo Model Products, *P.O. Box 236, Nestor, CA 92053.*

VS Sailplanes, *2317 N. 63rd, Seattle, WA 98103.*

Douglas Aircraft, *P.O. Box 92472, Long Beach, CA 90809.*

Ross Models, Inc., *708 Dermody Way, Sparks, NV 89431.* ■

CLASSIFIED

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SEND AD AND PAYMENT TO:
CLASSIFIED ADS, MAN, 251 Danbury Rd., Wilton, CT 06897
ATTN: Laura Kidder

WANTED: Model airplane engines and model race cars made before 1950. Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063; (918) 245-3649.

PLANS ENLARGED, Large Scale Specialists. PC Model Software. Free information. Concept, P.O. Box 669E, Poway, CA 92074-0669; (619) 486-2464.

WANTED: Berkeley and Cleveland kits or related items: parts, plans, boxes, brochures, books, ads, radio equipment, accessories, etc. Gordon Blume, 4649-191st Ave. S.E., Issaquah, WA 98027.

GIANT SCALE PLANS by Hostetler. We fly what we draw. Send SASE to Wendell Hostetler's Plans, 1041 B Heatherwood, Orrville, OH 44667.

ANTIQUE IGNITION AND GLOW PARTS CATALOGUE: 100 pgs., timers, needle valves, original cylinder heads, point sets, drive washers, stacks, spark plugs, plans. Engines: Atwoods, Baby Cyclones, McCoys, Hornets, others. $8 postpaid U.S., Foreign $20. Chris Rossbach, R.D. 1 Queensboro Manor, Box 390, Gloversville, NY 12078.

R/C WORLD—ORLANDO, FL, CONDO RENTALS—2 bedroom-furnished. Available weekly or monthly. Low rates. 100 acre flying field with enclosed hangar. Swimming pool, tennis courts on site. Minutes from Disney World and Epcot Center. For information call Sharon, (800) 243-6685 or write to Air Age Inc., Condo Dept., 251 Danbury Rd., Wilton, CT 06897.

SCALE MODEL RESEARCH Aircraft Documentation. World's largest. Over 3,000 different Foto-Paaks and 10,000+ drawings. Catalogue $4. 2334 Ticonderoga, Costa Mesa, CA 92626 (714) 979-8058.

WANTED: Old unbuilt plastic model kits. Planes, military, figures, cars, promos. Aircraft or missile desk models. Send list, price. Models, Box 863, Wyandotte, MI 48192.

INTERNATIONAL AIRCRAFT RESEARCH— Need documentation? Include name of aircraft for availability of documentation with $3 for 3-view and photo catalogue. 1447 Helm Crt., Mississauga, Ontario, Canada L5J 3G3.

HELICOPTER SCHOOL: 5 days of hands-on instruction with X-Cell Helicopters and Futaba computer radios. Small classes, tailored to your individual needs. Beginner to expert. Includes all meals and lodging. Over 80 satisfied students and 2,600 flights logged in our first 8 months of operation. Located on a 67-acre airport used exclusively for R/C training. Owned and operated by Ernie Huber, five-time National Helicopter Champion and helicopter designer. Winter and spring classes run January 7 through June 21. Write for free information and class schedule *now* to R/C Flight Training Center, P.O. Box 727, Crescent City, FL 32112-0727, or call (904) 698-4275.

USED ENGINES WANTED—Ignition, glow, diesel. Send description and price for prompt reply. T.Crouss, 100 Smyrna St., West Springfield, MA 01089.

ENGINES: Ignition, glow, diesel. New, used, collectors, runners. Sell, trade, buy. Send SASE for list to Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555. (619) 375-5537.

ELECTRIC FLIGHT EQUIPMENT: *We cater to the electric flier!* The best and largest electric flight supply in the Northeast, specializing in *Astro Flight* equipment. Kits, motors, batteries and lightweight building supplies, plus everything else you need for electric flight. For a catalogue, send $4 (in the U.S.; $5, foreign) to CS FLIGHT SYSTEMS, 31 PERRY ST., MIDDLEBORO, MA 02346, or call (508) 947-2805 to order. Visa, Mastercard.

COMPUTERIZED AIRCRAFT PLOTS: Technical illustrations suitable for framing. Three-views. Computer scale drafting and scanning services. Turn old prints into masterpieces! Catalogue, $1. D-TECH SYSTEMS, Rte. 2, Box 191-14, Carterville, IL 62918

GIANT-SCALE FLY-IN VIDEO—$19.95 plus $3.50 shipping. Airplane Video, P.O. Box 8577, Norfolk, VA 23503. (804) 480-1553.

BERKELEY, CLEVELAND, ETC., replica kits, duration rockets for jet models. Send two stamps to: WILLAIRCO, 2711 Piedmont Rd. NE, Atlanta, GA 30305.

WARBIRD VIDEOS: Over 100, low as $12. Free brochure. Videos, 54533 Terrace Ln. 152, South Bend, IN 46635.

HARDWARE, SOCKET-HEAD CAP SCREWS @ excellent prices. Example: alloy socket-head cap screws 4-40x1/2, $4.15/100; or stainless, $5.95/100. For free catalogue, write to Micro Fastners, 110 Hillcrest Rd., Flemington, NJ; or telephone (908) 806-4050.

WANTED: Model engines and race cars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105, (806) 622-1657

WANTED: MIDWEST A-4: any condition (even wrecked!). Also, any other ducted-fan planes, kits, plans, accessories, or wrecks. Please call with details. Chris, (918) 663-7847 or 734-0637.

OLD-TIMERS, take a ride back in time to airplane modeling roots with this vintage book—*Gas Models.* A true collector's book from the early editors of *Model Airplane News*, it contains the best of modeling from the '30s and '40s, including great technical information and classic construction articles from the Golden Age period. $7.95, add $2.95 S&H for first item; $1 for each additional item. *Foreign:* (including Canada and Mexico)—*surface mail,* add $4 for first item, $2 for each additional item; *airmail,* add $7 for first item, $2.50 for each additional item. Payment must be in U.S. funds drawn on a U.S. bank, or by international money order. Connecticut residents add 8% tax. Air Age Mail-Order Service, 251 Danbury Rd., Wilton, CT 06897.

CASH OR TRADE for your old clunker ignition engines and twins. Plans: 1/4-scale Piper Tri-Pacer, Aeronca "K," Puss Moth, Leopard Moth–all four sets, $100. Send large SASE for latest. Carl V. Miller, 130 Yucca Dr., Sedona, AZ 86336.

PRECISION SCALE WHEELS & TIRES—Custom-designed aluminum wheels, solid rubber tires. Each set is not only the scale size for your individual aircraft, but is as scale as possible in every respect. Custom orders are accepted for any aircraft. Pneumatic brakes available. F-100 D 1/10-scale available now: semi-kit, $239; complete kit, $339. Available soon: F-15, MiG-29, F-18 and F-105. For more details, call or write Glennis Aircraft, 5528 Arboga Rd., Linda, CA 95901. Tel.: (800) 688-3957 or (916) 742-3957.

EMBROIDERED EMBLEMS, enamel pins. Your design; excellent quality; free booklet. A.T. Patch Co., Dept. 68, P.O. Box 682, Littleton, NH 03561. Tel.: (603) 444-3423.

1930s to 1950s model airplane magazines; 1930s aviation pulps, complete and good condition; $1 for list. Bruce Thompson, 328 St. Germain Ave., Toronto, Ontario, Canada M5M 1W3.

WANTED: I will buy your old, outdated R/C systems. Ron Gwara, 21 Circle Dr., Waverly, NY 14892. Tel.: (607) 565-7486.

SCALE DOCUMENTATION, PLAN ENLARGING. 88 super-scale, giant, sport R/C construction plans; three-views; cutaway drawings. 85,000 documentation photos in stock; 125-page catalogue, $5 ($9 overseas). Jim Pepino's Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403. Tel.: (919) 292-5239. Visa, Mastercard.

BUY DIRECT AND SAVE—Open your own hobby shop. We can help. Send SASE and $5 to: Radio Rentals, 316 S. 10th St., Dept. MAN, Estherville, IA 51334.

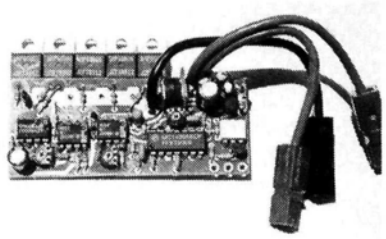
WANTED: New, unbuilt, no. 804 Guillows deHavilland Mosquito kit or plans. Holly Saleta, 2629 Isabella Ave., St. Augustine, FL 32086. Tel.: (904) 794-1047.

7-FOOT & 11-FOOT WINGSPAN—BV138 German, three-engine flying-boat, precision-scale plans. Five sheets (7 1/2x3 feet). Details and photo for two stamps. Gene Falada, 22W070 Byron Ave., Addison, IL 60101.

FOR SALE: Florida hobby shop; profitable business specializing in R/C. For info, write to 1808 Catawba St. Columbia, SC 29205.

PRODUCT NEWS

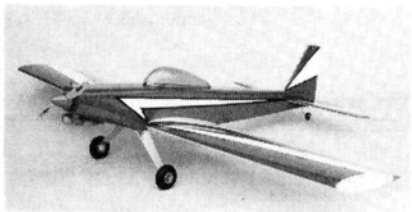
Descriptions of new products appearing in these pages were derived from press releases by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by Model Airplane News, or guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in Model Airplane News.



JOMAR PRODUCTS
SC-6 High-Power Electric Motor Throttle

Designed especially for 40- and 60-size (or larger) electric motors, Jomar Products' SC-6 High-Power Electric Motor Throttle can handle 12 to 35 cells at continuous currents up to 50 amps. It has a 250A surge-current rating, special circuitry that's designed to minimize abrupt changes in motor speed, and optical isolation that prevents motor noise from reaching the receiver. Adjustable neutral, sensitivity and current limiting make the SC-6 a natural choice for high-powered electric flight. The unit comes equipped with Sermos connectors and a Futaba "J" lead for the receiver.

For more information, contact Jomar Products, 2028 Knightsbridge Dr., Cincinnati, OH 45244.



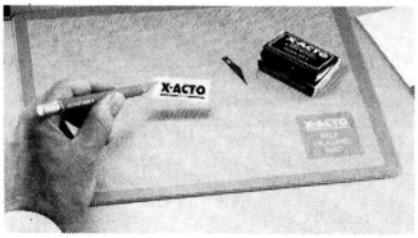
CARDEN CORP.
Gambler 40

Carden proudly introduces a new sport/aerobatic design—the Gambler 40. Engineered to accept .40 to .53 4-stroke or .40 to .45 2-stroke engines, this plane offers smooth performance throughout a wide speed range, and its landings are slow and predictable. It performs crisp, precise advanced aerobatics, including point and knife-edge maneuvers, and it makes a great second airplane for aerobatic training. Wingspan: 56 inches; wing area: 630 square inches; weight: 5 1/4 to 5 3/4 pounds; wing loading: 19 to 21 ounces per square foot.

The kit includes few parts; it builds straight, strong and light; and it should be ready for covering in 8 to 10 hours. The kit includes the finest-quality, hand-selected and matched balsa; precision-cut parts that are edge-trued for a perfect fit; a foam-core wing with balsa skins; custom ailerons; and top-quality hardware.

Price: List—$114.95; introductory special—$79.95, plus $5 S&H.

For more information, contact Carden Corp., 1731 NW Madrid Way, Boca Raton, FL 33432.



X-ACTO
Self-Healing Cutting Mats

X-Acto's Self-Healing Mats protect work surfaces from cuts. They offer a cutting base with a resilient surface that seems to close around cuts as quickly as they're made. The gray opaque mat has a non-slip bottom that prevents it from sliding; the white translucent mat is 1.7mm thick. Both have a grid-lined surface that's scaled in 1/16-inch increments, and this aids in squaring and measuring accurate cuts. Self-Healing Mats are available in 9x12-inch, 12x18-inch, 18x24-inch and 24x36-inch sizes.

For more information, contact Hunt Manufacturing Co., 230 S. Broad St., Philadelphia, PA 19102.

PILOT MODEL CO.
The Load Star

Why go through the trouble of designing and scratch-building your own photo-reconnaissance plane when you can buy a top-quality, ready-to-assemble, wooden kit from the Pilot Model Co.? The Load Star can carry up to 90 ounces of payload in its 4.75x7.0x8.5-inch cargo bay, and its 14-percent-thick, 12.5-inch-chord, flat-bottom airfoil provides great lift. Separate flaps and ailerons allow variable camber and short takeoffs and landings. The Load Star can easily carry an 8mm miniature video camera mounted in the shoot-through-the-windshield or shoot-through-the-belly position, or you can install a 35mm film camera to get dramatic in-flight photos.

The Load Star kit features quick-and-easy, tab-and-slot, lite-ply fuselage construction; precisely die-cut balsa wing and stab parts; pre-cut shear webbing; pre-shaped spruce wing joiners and hardened-aluminum landing gear; aluminum wing struts; and spring-steel tail gear. Span: 76.75 inches; wing area: 945 square inches; empty flying weight: 7.7 pounds; engine: .40 to .45 2-stroke, .60 to .90 4-stroke; radio: five or more channels required.

Part no. 100013

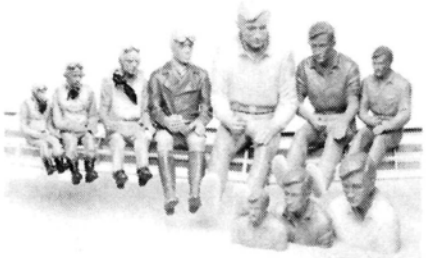
Price: $186.95

For more information, contact Hobby Shack, 18480 Bandilier Circle, Fountain Valley, CA 92728.

HITEC RADIO CONTROL USA, INC.
Hitec Focus Radio Systems

Hitec R/C USA has released four new Focus Series radio systems for R/C aircraft: a 4-channel standard, a 4-channel electric, a 6-channel and a 5-channel helicopter. To provide modelers with top quality at an affordable price, these systems include the latest SMT design and component technology. They're all AMA listed 1991 FM, dual conversion and RCMA gold-stickered. Exclusive features include the popular RCD Platinum receiver, high-quality precision gimbals with adjustable stick and tension, a Sanyo Ni-Cd airborne pack and an ergonomically designed transmitter case for fatigue- and error-free operation.

For more information, contact Hitec R/C USA, Inc., 9419 Abraham Way, Santee, CA 92071.

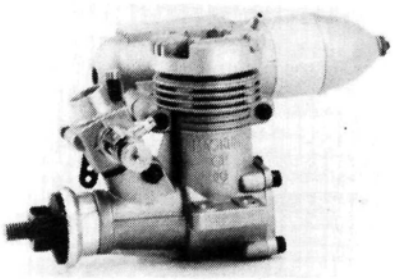


OFFICERS AND GENTLEMEN
Scale Pilots

Officers and Gentlemen makes civilian busts and full figures in 1/3, 1/4 and 1/5 scale. Military enthusiasts will like the full figures of a WW II U.S. Navy pilot in 1/5 scale and a 1/6- or 1/8-scale WW II USAF pilot outfitted with parachute straps, Mae Wests, oxygen masks and goggles. There's also a 1/4-scale WW I flier who comes complete with leather jacket, cap and flying boots and doubles as a barnstormer. Military pilot busts have been added to the line in the same scale as the full figures. All pilots are made of soft, light, "flesh"-colored vinyl and can be painted with water-based acrylic paints.

Price: $19.95 (full figures); $12.95 (military busts); $7.95 (civilian busts).

For more information, contact Officers and Gentlemen, P.O. Box 187, Sky Manor Airport, Pittstown, NJ 08867.



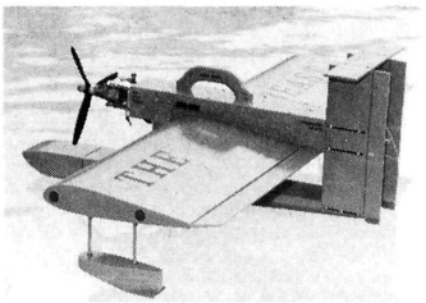
GLOBAL HOBBY DISTRIBUTORS
Magnum GP.10 ABC/FSR Aircraft Engine

The Magnum is a great-running, reliable engine that's designed for smaller aircraft. With front-rotor Schnuerle porting, chrome-plated brass cylinders, aluminum-alloy pistons, bronze Oilite bearings, reverse-cone adjustable-exhaust deflection mufflers with noise-reduction chamber, and "fine-tunable" carburetors, this engine can really put out the ponies! All powerful, dependable Magnum engines are protected by a two-year, unconditional manufacturer's guarantee of quality and performance.

Part no. 213210

Price: $68.95

For more information, contact Global Hobby Distributors, 18480 Bandilier Circle, Fountain Valley, CA 92728.

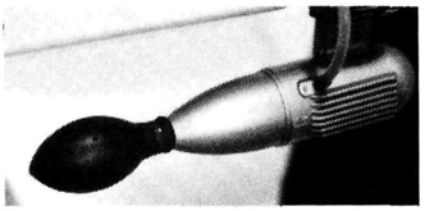


JOHN SULLIVAN MODEL FLOATPLANE PRODUCTS
The Beast

John Sullivan Model Float Products announces its first floatplane kit. A .40- to .60-size sport seaplane designed by Ed Westwood and Paul Weston, the Beast has a 48-inch span and 712-square-inch area. The kit features quick-to-build construction, and it includes foam wing cores and float cores, all sheeting, lite-ply-and-balsa fuselage and empennage components. The Beast is a good intermediate trainer at low speed and a great aerobatic performer at high speed.

Price: $84.50, plus $9.25 S&H

For more information, contact John Sullivan Floatplane Products, 1421 Second St., Calistoga, CA 94515.



KDI
Rubber-After Muffler

KDI's Rubber-After Muffler reduces 2-stroke engine noise. It's made of a silicone-based material that can withstand both the heat and the chemicals of model engine exhaust. It won't slide off in flight (like some exhaust diverters), and it's so light that it won't damage your engine in a crash. It's easy to install and can easily be removed and used in another model. With this muffler, many fliers have measured 6dB attenuation with little, if any, rpm loss, and some have even picked up power. The Rubber-After Muffler is available in two sizes: .20 to .46 and .50 to .90.

For more information, contact KDI, 10426 SE 206 Place, Kent, WA 98031.

MODEL AIRPLANE NEWS

HOBBY SHOP DIRECTORY

Retailers: Make your business grow with new traffic! Now you can advertise your hobby shop in the **Model Airplane News Hobby Shop Directory**. The listing will be published monthly and will be listed according to city and state. You will have 3 to 4 lines, approximately 20 words, in which to deliver your sales message, plus space for your store's name, address, and telephone number.

HOBBY SHOPS: Act now and get first ad free!

Directory space is sold on a yearly basis with a choice of three payment plans: 1. $179 per year, payable in advance; 2. $97 for six months, payable in advance; or 3. $17.50 per month to be billed monthly. Space reservations must be received by the 10th of the third month preceding publication (for example, January 10th for the April issue).

ALABAMA—Huntsville
4.5 miles east of the Alabama Space and Rocket Center. Complete line of Radio-Control, Free-Flight, and Control-Line Airplanes and Hardware, HO&N Scale Trains, Rockets, Ships, and Plastics. Hours: Mon-Fri, 9-6; Sat, 8-5; Sun, 12-5. Daily UPS pickup.
WILSON'S HOBBY SHOP
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CONNECTICUT—Norwalk
Connecticut's leading R/C shop, 15 years experience flying and selling radio control. Over 3,500 different items in stock. Custom ordering for hard-to-find parts.
AL'S R/C SUPPLIES
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- Send $3 for yellow info pack
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- Visit our showroom (35 min. from Disney World)

BOB FIORENZE HOBBY CENTER, INC.
420 W. S.R. 434
(407) 327-6353 **FAX (407) 327-7148**

ILLINOIS—Chicago
Chicago's largest hobby shop. R/C planes, helicopters, boats, and cars. R/C Repairs, installations, and custom building. Mon.-Fri. 10-9; Sat. 9-6; Sun. 11-4.
STANTON HOBBY SHOP, INC.
4734 Milwaukee Ave. **(312) 283-6446**

NEW JERSEY—New Brunswick
R/C Helicopters: Concept, Schluter, Parts & Accessories
R/C Cars, Boats, Parts & Accessories
Customer Support Available
"A Daddy's Toy Store"
HOVER CENTER PLUS, INC.
131 French St. **(908) 937-5828**

OHIO—Findlay
Findlay's local R/C dealer, planes—cars—boats. We specialize in R/C, large selection of kits, accessories, and parts. We are authorized Sig and Dremel dealers. Also sell plastic kits and model rockets. Tue. & Thu. 3-9, Mon., Wed., Fri., & Sat. 10-9.
JINX MODEL SUPPLIES
721 Rockwell Ave. **(419) 422-5589**

OKLAHOMA—Tulsa
R/C Specialists, planes, helicopters, cars and boats. We also have kites, boomerangs and plastics. Experienced personnel to answer all your questions. AE, Visa, MC. Hours: Mon.-Sat. 10-6, Thurs. 10-8.
WINGS 'N THINGS HOBBY SUPPLY, INC.
5241 S. Peoria Ave. **(918) 745-0034**

LATIN AMERICA
COSTA RICA—San Jose
Complete line of R/C airplanes, cars, boats, and helicopters. Parts and professional expert service and advice. Julio Pastura, President. Weekdays 4-10 p.m.
EL HOBBY SHOP
Centro Commercial, San Jose 2000
Apartado 529, Centro Colon **32-26-81**

Send sales message and payment to
Model Airplane News Hobby Shop Directory,
251 Danbury Rd., Wilton, CT 06897.
For further details or information on our special introductory offer, call toll-free 1-800-243-6685 and ask for Laura Kidder.

SUNFLY

(Continued from page 116)

Including the cost of a computer radio, the Sunfly isn't a low-budget operation at over $1,000 (less with a standard radio). The plane's performance matches its price, which, by comparison to that of a modern sailplane kit, is reasonable. If you want a high-performance electric and don't want to design your own, this is the only show in town.

Is it "the nearly ultimate model airplane?" I've never seen a power ship with comparable soaring and aerobatic potential. The Sunfly redefines the capabilities of electric models for nearly everyone who sees it fly.

**Here are the addresses of companies mentioned in this article:*
Hobby Lobby International, *5614 Franklin Pike Cir., Brentwood, TN 37027.*
Rohacell, *distributed by Composite Structures Technology, P.O. Box 4615, Lancaster, CA 93539.*
Airtronics, *11 Autry, Irvine, CA 92718.*
Oracover, *distributed by Hobby Lobby.*
SR Batteries, *P.O. Box 287, Bellport, NY 11713.*
AstroFlight, *13311 Beach Ave., Marina Del Rey, CA 90292.*
Sermos R/C Snap Connectors, *Cedar Corners Station, P.O. Box 16787, Stamford, CT 06905.*
Graupner, *distributed by Hobby Lobby.* ■

GIANT STEPS

(Continued from page 71)

the jig for the next rib. When I take the ribs out of the jig, I slip a metal ruler under them, move it along and wiggle it slightly to remove the rib with a minimum of

(Continued on page 127)

GIANT STEPS

trouble. It's not obvious in the photo, but I cut a small semicircular notch just behind the trailing-edge strip. This allows me to get a fingernail or the point of a knife under the trailing-edge stock to start removing the rib.

Having removed the rib from the jig, I apply a second set of gussets to the other side of the rib, sand the gussets' edges lightly to remove any protrusions, and the rib is complete.

Note that the ribs have slots for box spars, and one of the photos shows a pair of ribs threaded onto the appropriate box spars. These spars are built up with two pieces of square spruce and two strips of plywood. (The sizes of the spar parts are appropriate to the wing you're building, of course.) The wing rib shown has a square corner at the bottom of the spar opening, but the top of the spar opening angles at a slant in conformance with the airfoil, so the spar must be sanded or planed down to the appropriate angle. The spars fit closely in the spar opening. When the ribs and spars have been glued together, they form a very strong assembly.

(Continued on page 130)

ADVERTISER INDEX

GIANT STEPS

(Continued from page 127)

To increase strength, you may install drag and anti-drag braces between the ribs.

Though it's true that all this lovely work is covered in the completed model, it's still satisfying to know it's in there, under the covering. In addition, this structure is lighter and stronger than conventional balsa-sheet ribs. If you're into nice construction, you'll enjoy this type of work as much as I do.

• **Hinges.** I like my hinges to move freely, without resistance. It's also a good idea to inhibit the airflow between hinged surfaces; it makes them more effective and provides better control. Both of these requirements can be easily, conveniently and inexpensively met by using hinges you can make yourself. The basic material is Permagloss Coverite*, that's cut into 1½-inch-wide strips of the appropriate length. Hold two of these strips with their adhesive sides together; then sew them together with a single seam along the center. Cut this hinge strip to any length you require, and apply it to the appropriate control surfaces in the usual way (using an iron).

Finish these hinges with any of the materials usually used on Coverite. If you use a primer properly, you could prime and sand in such a way that you make the hinge material all but invisible. When you've added the final color coat, they'll *be* invisible and, despite the paint and primer, will still be very flexible. I've used them on every control surface, including ailerons. They're efficient, inexpensive and do exactly what a hinge should do.

That's it for this month. I hope you'll join me here next time for more information on building large models.

**Here are the addresses of the companies mentioned in this column:*
***Bob Holman Plans,** P.O. Box 741, San Bernardino, CA 92402*
***ViP Publishers, Inc.,** P.O. Box 16103, Colorado Springs, CO 80935.*
***"Building Big Is Beautiful";** available from ViP Publishers ($11.95, plus $2 S&H).*
***Hot Stuff;** distributed by Satellite City, P.O. Box 836, Simi, CA 93062.*
***Coverite,** 420 Babylon Rd., Horsham, PA 19044.* ■